



Fall Protection

British Columbia OHSR Compliant

Student Manual

First Edition V 2.1

November 6, 2019

No part of this manual may be reproduced in any form or by any means, for any purpose without the express written permission

of:

Saga Universal Training Corporation

Unless otherwise indicated, any document or Power Point Slide in any form (print or electronic) bearing the SAGA Universal Training Corporation logo



is under copyright of SAGA Universal Training Corporation

Saga Universal Training Corp. is dedicated to reducing deaths caused by illness and injury. This training course is intended to supplement employer training programs. Readers should not assume that reviewing this manual alone constitutes complete Fall Protection Training.

For further information contact:

Saga Universal Training Corporation

E: mail - info@sagatraining.ca

Web Page - www.sagatraining.ca

Saga Universal Training Corp. wishes to acknowledge the efforts of all the people who contributed to the writing, editing, and layout of this manual. It is our hope that this manual and the resulting training program will aide in the reduction of preventable injuries with the necessary knowledge, skills and confidence to understand hazards associated with falls in the work place.

SAGA Universal Training Corporation gratefully acknowledges ...



... for permission to use their copyrighted images and information in this presentation and student manual.



... for their contributions to the course material

Contents

Housekeeping & Course Administration	2
Housekeeping	2
Course Administration	3
How to successfully complete this course:	4
Instructor's Roles and Responsibilities	4
Purpose	6
Goals of this Course:	7
Introduction	8
Chapter 1 Oversight:	11
Legislation, Regulations, Standards, Due Diligence, and Best Practices	12
General Duties of Employers, Workers and Others	13
Standards	16
Due Diligence	17
Best Practices	17
Section 217.1 of the Criminal Code of Canada	
Requirement to Comply	19
Chapter 2: An Overview of Related BC Legislation	22
OHS Regulation Part 2: Application	23
OHS Regulation Part 3: Rights and Responsibilities	24
Procedure for refusal	24
OHS Regulation Part 4: General Conditions	25
Working Alone or In Isolation	25
Hazard identification, elimination and control	25
OHS Regulation Part 8: Personal Protective Clothing and Equipment	29
Chapter 3: Fall Protection Situational Awareness	35
OHS Regulation Part 11: Fall Protection	
Part 20. Construction, Excavation and Demolition	
Fall protection systems suitable for each type of roof	
Fall Hazard Area	
Hierarchy of Fall Protection	43
Fall Protection Plan	55
Chapter 4: Equipment	58
Lanyards	60

Maximum Arrest Force (MAF)	65
Energy Absorbers	65
Deployment Distance and Clearance	68
Carabiners and Snap-Hooks	70
Hazards Associated with Connecting Equipment	71
Fall Arresters	74
Self-Retracting Device	77
Self Retracting Devices and CSA classifications and Requirements	78
Equipment Standards	83
Vertical lifelines	83
Inspection and Maintenance	85
Maintenance	
Preventing Damage	88
Removal from Service Protocol	89
Chapter 5: Special Hazards	105
Clearance and Arrest Force	106
Arrest Force	107
Swing-Fall / Drop Hazard	110
Calculating Clearance Requirement	111
Water Danger	116
Chapter 6: Anchors	119
Independence of Anchors	122
Location and Strength of Anchors	123
Improvised Anchors	124
Load Capacity	125
Horizontal Lifeline Systems	132
Certification of Anchors by Engineer	134
Inspection and Removal of Anchors from Service	134
Chapter 7: Special Situations	139
Work Area Guards and Handrails	140
Ladders, Scaffolds and Temporary Work Platforms	141
High Risk Situations	143
Fall protection on Elevating Work Platforms	144
Construction, Excavation and Demolition	

Fall Protection in Masonry Construction	148
Fall Protection in Agriculture	
Fall Protection in Fixed Seating Areas	150
Fall Protection During Stunt Work	151
Standards for Equipment in a Fall Protection System	153
Re-using Equipment Used in Stunt Work After it has Arrested a Fall	156
Inspecting Equipment Used in Stunt Work	157
Chapter 8: Potential Injuries Due to Falls	162
Effect of Falling on The Human Body	163
Injury Prevention and Control	164
Suspension Trauma	165
Full Body Harness	167
Full Body Harness Donning	171
Full Body Harness Suspension	174
Chapter 9: Emergency Preparedness and Response	178
Rescue	179
Risk assessment	179
Emergency procedures	
Work at High Angles	181
Notice of Rescue Service for Short-Term Work	182
Application for Industrial Rescue Service	
Use Of 9-1-1 For Rescue	
Evacuation by air	
Emergency Response Plan	184
Initial Response to A Worker Who Has Fallen	185
Follow-Up	

This Page Left Blank Intentionally

Housekeeping & Course Administration

Housekeeping

Evacuation Procedure Fire escape route

Muster point

Emergency Procedure

First aid Kit & AED location Designated First-Aid Provider Location Address Emergency Services Phone Number

Breaks and Attendance

Coffee time and breaks (minimum 20 minutes throughout the day) Lunch time and Length (minimum 30 minutes) Cell phone policy (cell phone use outside) Classroom Attendance Policy Approximate completion time

Facility Amenities

Washrooms Refreshments Smoking Area

Student Introductions Name Background/Employer Experience

Instructor Introduction

Name

Background

Experience

Role of the Instructor

Course Administration

Privacy Policy

Student data sheet

Universal Course Design

Clients' requests for special accommodations (course delivery, exam, etc.) as per SAGA Universal Design policy.

Students requests for special accommodations (verbal exam, extra time, etc.) as per SAGA Universal Design policy.

Student Certificates

Explanation of certificate data points Certification issuance procedure Certification Expiry Notice of Expiry Policy

Harness Suspension

Every student must inspect and properly don a full body harness under the supervision of the instructor

Students are encouraged to participate in the harness suspension.

Students who do participate in the harness suspension must complete the declaration of physical ability to perform full-body-harness suspension.

Harness Suspension Safety Policy must be adhered to.

Standard Assessment

Harness Inspection Full-Body-Harness fitting Achieve 80% on open book test (one-hour time limit)

Student Course Evaluation Policy

How to successfully complete this course:

- Pay attention
- Ask questions
- Make notes (this is your book, use the pages at the beginning of each chapter).
- When completing the test read the questions and answers carefully.
- Don't rush through the test, the instructor is always the last person in the room.

Instructor's Roles and Responsibilities

Instructors authorized to instruct SAGA courses must meet certain criteria through varying competencies including but not limited to; work experience, subject matter expertise, and instructional training, education, and experience.

Instructors are responsible for the competent delivery of the course material in a manner that gives the students the opportunity to understand and learn the information in the course.

To achieve that goal the instructor will;

- Begin each chapter with a review of the content (experience of the students).
- Briefly overview the material to be covered in the chapter (Goal and Objectives).
- Present the material in the chapter.
- Review the exercise at the end of each chapter with the students.
- Verify with the students that all objectives were completed.

This Page Left Blank Intentionally

Purpose

This course is an introduction to fall protection. Saga Universal Training Corp. is dedicated to reducing deaths caused by illness and injury. This training course is intended to supplement employer training programs. Readers should not assume that reviewing this manual alone constitutes complete Fall Protection Training.

This manual is based upon The Workers' Compensation Board of B.C. ("WorkSafeBC") on-line version Occupational Health and Safety Regulation ("OHS Regulation") as amended from time-to-time.

READ WorkSafeBC DISCLAIMER BELOW.

Disclaimer: The Workers' Compensation Board of B.C. ("WorkSafeBC") publishes the online version Occupational Health and Safety Regulation ("OHS Regulation") in accordance with its mandate under the Workers Compensation Act to provide information and promote public awareness of occupational health and safety matters.

The online OHS Regulation is not the official version of the OHS Regulation, which may be purchased from Crown Publications. WorkSafeBC endeavours to update the online OHS Regulation as soon as possible following any legislative amendments.

However, WorkSafeBC does not warrant the accuracy or the completeness of the online OHS Regulation, and neither WorkSafeBC nor its board of directors, employees or agents shall be liable to any person for any loss or damage of any nature, whether arising out of negligence or otherwise, arising from the use of the online OHS Regulation.

Employers are legally obligated to make a copy of the Workers Compensation Act and the OHS Regulation readily available for review by workers. The circumstances under which WorkSafeBC may consider an employer's providing access to electronic versions of the Act and OHS Regulation to have satisfied this obligation are described in Guideline G-D3-115(2)(f).

Although you could say that all regulations apply to every employer and worker, but that would only be true if the work and work environment was within the scope of the regulations. There are, however, some Parts of the regulations that do apply to every employer and worker as indicated in the regulations – those will be addressed in this course. Then, there are some Sections of Parts that are related indirectly – those will also be addressed. Finally, there is a Part that is directly related to Fall Protection – Part 11, will be discussed in detail.

There may be OH&S Regulations that affect individual employers and employees that is not covered in this course. It is the employers' and employees' responsibility to ensure they are compliant with all Parts of the OH&S Regulation that apply to their workplace.

Goals of this Course:

- The student will have an awareness of the various legislation and regulations that pertain to fall protection.
- Ensure the student is aware of the regulations and any applicable orders that relate to fall protection.
- Ensure that the student has a situation awareness of fall protection.
- The student will understand the advantages, disadvantages, limitations, hazards, and importance of inspections associated with various fall protection components and equipment used in fall protection.
- The student will be able to reduce the risk of hazards associated with Clearance, Arrest force, Swing-fall / drop, and water hazards.
- The student will have an awareness of the skills necessary to be able to assess an anchor's strength, stability and location.
- The student will have an awareness of various fall protection systems used for unique work areas and tasks.
- The student will understand the effect of a fall on the human body, and how to reduce the risk of injuries due to a fall.
- The student will understand emergency response requirements at work sites.

Introduction

Falls are one of the leading causes of injuries and deaths in the workplace. The elimination of fall hazards and the reduction of risk through the application of various fall protection systems can substantially reduce injuries due to falls.

Types of Fall Hazards

- Trips and slips
- Edge
- Excavation
- Hole
- Opening
- Equipment

Falls are the leading cause of death in the construction industry

How far will you fall in 2 seconds?	
How fast will you be falling?	



What is Fall Protection?

- Fall protection is a planned system used to protect workers from death or potential injury if they lose their balance while performing a task at height.
- A "system" is a set of detailed methods, procedures, and routines created to carry out a specific activity, perform a duty, or solve a problem.
- If one part of a system fails the entire system fails.
- A great diversity of personal fall protection systems are used by workers who have to work at height to position the worker or to restrain his/her movements in order to prevent falls or to protect him/her in case of fall.
- A fall arrest system is used where there is a risk of free fall from height.
- Competent workers using appropriate procedures, equipment and training can reduce the risk of injuries due to falls.

Competency

- Competent is defined as follows: "competent" in relation to a person, means adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision, or with only a minimal degree of supervision.
- It is your employer's responsibility to ensure you are trained in the use of all workplace regulations, related policies, related guidelines, procedures, and equipment used at your work site.
- Only your employer can assess your experience and determine your competency. However, the worker also has a responsibility to ensure they have the training and experience to work safely.
- This course is designed to introduce the learner to the basic concepts, hazards, hazard control processes and safe work procedures associated with fall protection.

Chapter 1 Oversight:

There are many layers of oversight of safety requirements in the workplace that are often in a hierarchical form of priority. For example, federal laws and regulations normally supersede provincial authority, but in some instances the federal government has given authority to the provinces.

Goal:

The student will have an awareness of the various legislation and regulations that pertain to fall protection.

Objective:

1. The student will be able to explain the relationship between Legislation, Regulations, Standards, Due Diligence, and Best Practices.

Legislation, Regulations, Standards, Due Diligence, and Best Practices

In Canada OH&S is a provincial jurisdiction and every province has its own OH&S legislation, code, and regulations. However, some industries are federally regulated, which can bring OH&S for those industries under the Canadian Labor Code and under federal jurisdiction.

In BC the authority of OHS Regulations stems from;

Work Safe C Workers' Compensation Act

Worker Compensation Act – Part 3 OHS

Section 108 Application of Part
(1) Subject to subsection (2), this Part applies to
(a) the Provincial government and every agency of the Provincial government,
(b) every employer and worker whose occupational health and safety are ordinarily within the jurisdiction of the Provincial government, and
(c) the federal government, every agency of the federal government and every other person whose occupational health and safety are ordinarily within the jurisdiction of the Parliament of Canada, to the extent that the federal government submits to the application of this Part.
(2) This Part and the regulations do not apply in respect of
(a) mines to which the Mines Act applies,
(b) [Repealed 2004-8-33.]
(c) subject to subsection (3), the operation of industrial camps to the extent their operation is subject to regulations under the <i>Public Health Act</i> .

Worker Compensation Act – Part 3, Division 3 General Duties of Employers, Workers and Others

General Duties of Employers

Every employer must:

- ensure the health and safety of

 (i) all workers working for that employer, and
 (ii) any other workers present at a workplace at which that employer's work is being carried out, and
- comply with this Part, the regulations and any applicable orders.
- remedy any workplace conditions that are hazardous to the health or safety of the employer's workers,
- ensure that the employer's workers
 - (i) are made aware of all known or reasonably foreseeable health or safety hazards to which they are likely to be exposed by their work,
 - (ii) comply with this Part, the regulations and any applicable orders, and
 - (iii) are made aware of their rights and duties under this Part and the regulations,
- establish occupational health and safety policies and programs in accordance with the regulations,
- provide and maintain in good condition protective equipment, devices and clothing as required by regulation and ensure that these are used by the employer's workers,
- provide to the employer's workers the information, instruction, training and supervision necessary to ensure the health and safety of those workers in carrying out their work and to ensure the health and safety of other workers at the workplace,
- make a copy of this Act and the regulations readily available for review by the employer's workers and, at each workplace where workers of the employer are regularly employed, post and keep posted a notice advising where the copy is available for review,
- consult and cooperate with the joint committees and worker health and safety representatives for workplaces of the employer, and
- cooperate with the Board, officers of the Board and any other person carrying out a duty under this Part or the regulations.

General Duties of Employers, Workers and Others (continued)

General Duties of Workers

Every worker must:

- take reasonable care to protect the worker's health and safety and the health and safety of other persons who may be affected by the worker's acts or omissions at work, and
- comply with this Part, the regulations and any applicable orders.
- carry out his or her work in accordance with established safe work procedures as required by this Part and the regulations,
- use or wear protective equipment, devices and clothing as required by the regulations,
- not engage in horseplay or similar conduct that may endanger the worker or any other person,
- ensure that the worker's ability to work without risk to his or her health or safety, or to the health or safety of any other person, is not impaired by alcohol, drugs or other causes,
- report to the supervisor or employer

 (i) any contravention of this Part, the regulations or an applicable order of which the worker is aware, and
 (ii) the absence of or defect in any protective equipment, device or clothing, or the existence of any other hazard, that the worker considers is likely to endanger the worker or any other person,
- cooperate with the joint committee or worker health and safety representative for the workplace, and
- cooperate with the Board, officers of the Board and any other person carrying out a duty under this Part or the regulations.

General Duties of Employers, Workers and Others (continued)

General Duties of Supervisors

Every supervisor must:

- ensure the health and safety of all workers under the direct supervision of the supervisor,
- be knowledgeable about this Part and those regulations applicable to the work being supervised, and
- comply with this Part, the regulations and any applicable orders.
- ensure that the workers under his or her direct supervision

 (i) are made aware of all known or reasonably foreseeable health or safety hazards in the area where they work, and
 (ii) comply with this Part, the regulations and any applicable orders,
- consult and cooperate with the joint committee or worker health and safety representative for the workplace, and
- cooperate with the Board, officers of the Board and any other person carrying out a duty under this Part or the regulations.

The preceding information on General Duties is a summary of an excerpt from the Worker Compensation Act – Part 3, Division 3 – General Duties of Employers, Workers and Others. You may review the full text and related policies and guidelines through WorkSafeBC's on-line resources

Standards

- OH&S regulations often refer to standards. Where the regulation will require the worker to follow a particular standard or use equipment that has met the requirements of a specific standard.
- The standards organizations are not the government so they cannot implement regulations. However, the standards organizations are made up of experts in various disciplines. The standards organizations most frequently referenced in OH&S regulations are:
 - CSA Group, formerly the Canadian Standards Association (CSA) (CAN/CSA)
 - American National Standards Institute (ANSI)
 - American Society of Safety Engineers (ASSE)
 - European Committee for Standardization (CEN), or in French: Comité Européen de Normalisation) Conformité Européenne (CE),
 - National Fire Protection Association (NFPA),
 - Underwriters Laboratories of Canada (UL) (ULC)
 - Safety Equipment Institute (SEI)
- For compliance purposes, any equipment required to meet specific standards must bear the mark or label of a nationally accredited testing organization such as CSA, or ANSI, as evidence that the harness has been approved to the requirements of the Standard.

In BC, equipment used in fall protection must meet CSA or ANSI standards.





- Use caution when purchasing equipment required to meet the various standards.
- Manufacturers must meet stringent criteria to have their equipment tested to these standards.
- There have been cases of fraud where equipment has not been tested to the standards criteria and counterfeit marks are placed on the equipment.
- It is always best to purchase equipment from reputable and authorized dealers.

Play by the Rules

- Employers and workers must ensure they understand under which authority they are working.
- Employers and workers must be familiar with the legislation, regulations and standards they must follow.
- When a regulation requires certain standards to be followed, they must be followed just as if they were written verbatim in the regulation.

Due Diligence

- WorkSafeBC defines due diligence as follows: Due Diligence requires taking all reasonable steps to protect workers from harm. "All reasonable steps" is based on the level of judgment and care that a person would reasonably be expected to do under the circumstances.
- An organization that actively manages health and safety and takes all reasonable steps to protect workers from harm is being duly diligent.

Best Practices

A best practice is a method or technique that has been generally accepted as superior to any alternatives because it produces results that are superior to those achieved by other means, or because it has become a standard way of doing things.

- Best practices are used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment or benchmarking.
- A procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption.
- There are some standards that are not required to be followed by any regulations, but individuals and groups follow them because they produce results.
 - Another term to describe a best practice may be "Industry Standard"
 - – DO NOT confuse this with a formal standard from CSA, ANSI etc.

The Relationship Between Due Diligence and Best Bractices

- If due diligence in health and safety means to take all reasonable precautions, and best practices are used to maintain quality as an alternative to mandatory legislated standards; then wouldn't following best practices be considered as an example of due diligence?
- A standard not required through a regulation but has been generally accepted as superior could be considered a best practice and therefore should be followed to meet due diligence.

Example:

The OHSR in BC requires fall protection to be used if a worker could fall a distance of 3 metres (~ 10 ft) or more. However, if most employers require fall protection to be used at 6 ft., or less, should a worker be using fall protection at 10ft. or 6ft.?

Is there a difference between being legal and being safe?

Section 217.1 of the Criminal Code of Canada

One of the farthest-reaching mechanisms of oversight regarding health and safety is Section 217.1 of the Criminal Code of Canada:

"Everyone who undertakes, or has the authority, to direct how another person does work or performs a task is under a legal duty to take reasonable steps to prevent bodily harm to that person, or any other person, arising from that work or task."

Jurisdictions Summary



Requirement to Comply

Notwithstanding the requirement for competency (training and experience), appropriate equipment, and the right to refuse unsafe work:

- If legislation, regulations, or an adopted code imposes a duty on an employer, the employer must ensure that duty is met in accordance with the legislation, regulations, or the adopted code.
- If legislation, regulations, or an adopted code imposes a duty on a worker, the worker must perform that duty, and the employer must ensure the worker performs that duty in accordance with the legislation, regulations, or the adopted code.

Chapter 1 Exercise:

1. True or False?

Fall protection is a planned system used to protect workers from death or potential injury if they lose their balance while performing a task at height.

2. What is the leading cause of death for construction workers?(a) Office Work

(b) Angry Spouse

(c) Falling

(d) Drowning

3. True or False? Once training is complete you are competent.

4. Which of the following statements are true?(a) Employers and workers must be compliant with all applicable OHS Regulations.

(b) Due diligence means to take all reasonable precautions, under the circumstances, to prevent injuries or accidents in the workplace.

(c) Employers and workers must ensure they understand under which authority they are working and be familiar with the legislation, regulations and standards they must follow.

(d) All of the above are true.

Summary

What was covered in Chapter 1?

• The relationship between Legislation, Regulations, Standards, Due Diligence, and Best Practices.

Chapter 2: An Overview of Related BC Legislation

According to the Worker Compensation Act- Part 3, Division 3, General Duties of Employers:

Every employer must ensure that the employer's workers comply with this Part, the regulations and any applicable orders, and are made aware of their rights and duties under this Part and the regulations,

Goal: Ensure the student is aware of the regulations and any applicable orders that relate to fall protection.

Objectives:

1. The student will be able to demonstrate an awareness of regulations and applicable orders that relate to general safety duties.

2. The student will know where to find current regulations and applicable orders that relate to fall protection.

3. The student will understand their rights and responsibilities with respect to refusing unsafe work.

4. The student will understand their rights and responsibilities with respect to working alone.

OHS Regulation Part 2: Application

Scope of application

• This Occupational Health and Safety Regulation applies to all employers, workers and all other persons working in or contributing to the production of any industry within the scope of Part 3 of the Workers Compensation Act.

General Duty

• Despite the absence of a specific requirement, all work must be carried out without undue risk of injury or occupational disease to any person.

Conflict with a code or standard

• If there is any conflict between the requirements of this Regulation and any code or standard with which compliance is required by this Regulation, the provisions of this Regulation prevail.

Contravention

- A contravention of this Regulation will be deemed to be a contravention by the employer and will make that employer liable for any penalty prescribed by the Workers Compensation Act.
- A contravention of this Regulation by a supervisor or a worker will be deemed to be a contravention by the supervisor and will make that supervisor liable for any penalty prescribed by the Workers Compensation Act.
- A contravention of this Regulation by a worker will make that worker liable for any penalty prescribed by the Workers Compensation Act.
- A contravention of this Regulation by a person working in or contributing to the production of an industry within the scope of the Workers Compensation Act will make that person liable for any penalty prescribed by the Act.

OHS Regulation Part 3: Rights and Responsibilities

Procedure for refusal

- A person must not carry out or cause to be carried out any work process or operate or cause to be operated any tool, appliance or equipment if that person has reasonable cause to believe that to do so would create an undue hazard to the health and safety of any person.
- A worker who refuses to carry out a work process or operate a tool, appliance or equipment pursuant to subsection (1) must immediately report the circumstances of the unsafe condition to his or her supervisor or employer.
- A supervisor or employer receiving a report made under subsection (2) must immediately investigate the matter and
 - ensure that any unsafe condition is remedied without delay, or
 - if in his or her opinion the report is not valid, must so inform the person who made the report.
- If the procedure under subsection (3) does not resolve the matter and the worker continues to refuse to carry out the work process or operate the tool, appliance or equipment, the supervisor or employer must investigate the matter in the presence of the worker who made the report and in the presence of
 - a worker member of the joint committee,
 - a worker who is selected by a trade union representing the worker, or
 - if there is no joint committee or the worker is not represented by a trade union, any other reasonably available worker selected by the worker.
- If the investigation under subsection does not resolve the matter and the worker continues to refuse to carry out the work process or operate the tool, appliance or equipment, both the supervisor, or the employer, and the worker must immediately notify an officer, who must investigate the matter without undue delay and issue whatever orders are deemed necessary.

No discriminatory action

- Worker must not be subject to discriminatory action as defined in section 150 of Part 3 of the Workers Compensation Act because the worker has acted in compliance with section 3.12 or with an order made by an officer.
- Temporary assignment to alternative work at no loss in pay to the worker until the matter in section 3.12 is resolved is deemed not to constitute discriminatory action.

Note: The prohibition against discriminatory action is established in the Workers Compensation Act Part 3, Division 6, sections 150 through 153.

OHS Regulation Part 4: General Conditions

Working Alone or In Isolation

Definition

- "to work alone or in isolation" means to work in circumstances where assistance would not be readily available to the worker
 - in case of an emergency, or
 - in case the worker is injured or in ill health.

Hazard identification, elimination and control

- Before a worker is assigned to work alone or in isolation, the employer must identify any hazards to that worker.
- Before a worker starts a work assignment with a hazard the employer must take measures
 - to eliminate the hazard, and
 - if it is not practicable to eliminate the hazard, to minimize the risk from the hazard.

Note: the employer must minimize the risk from the hazard to the lowest level practicable using engineering controls, administrative controls or a combination of engineering and administrative controls.

Procedures for checking well-being of worker

- The employer must develop and implement a written procedure for checking the wellbeing of a worker assigned to work alone or in isolation.
- The procedure for checking a worker's well-being must include the time interval between checks and the procedure to follow in case the worker cannot be contacted, including provisions for emergency rescue.
- A person must be designated to establish contact with the worker at predetermined intervals and the results must be recorded by the person.
- In addition to checks at regular intervals, a check at the end of the work shift must be done.
- The procedure for checking a worker's well-being, including time intervals between the checks, must be developed in consultation with the joint committee or the worker health and safety representative, as applicable.
- Time intervals for checking a worker's well-being must be developed in consultation with the worker assigned to work alone or in isolation.

Note: High risk activities require shorter time intervals between checks. The preferred method for checking is visual or two-way voice contact, but where such a system is not practicable, a one-way system which allows the worker to call or signal for help and which will send a call for help if the worker does not reset the device after a predetermined interval is acceptable.

Training

A worker described in section 4.21(1) and any person assigned to check on the worker must be trained in the written procedure for checking the worker's well-being.

Annual reviews of procedures

The procedures must be reviewed at least annually, or more frequently if there is

- a change in work environment arrangements that could adversely affect
 - the effectiveness of the violence prevention program, or
 - a worker's well-being or safety, or
- a report that the procedures, policies or work environment arrangements, as applicable, are not working effectively.

Work Area Requirements

Slipping and tripping hazards

- Floors, platforms, ramps, stairs and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards.
- If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.

This Page Left Blank Intentionally

OHS Regulation Part 8: Personal Protective Clothing and Equipment

Selection, use and maintenance of PPE

Personal protective equipment must

- be selected and used in accordance with recognized standards, and provide effective protection,
- not in itself create a hazard to the wearer, (if it does and the risk is greater, other appropriate measures must be taken)
- be compatible, so that one item of personal protective equipment does not make another item ineffective, and
- be maintained in good working order and in a sanitary condition.

Program for PPE

- If personal protective equipment is required to protect against a chemical exposure or an oxygen deficient atmosphere the employer must implement an effective protective equipment program at the workplace which includes
 - a statement of purpose and responsibilities,
 - written procedures for selection, use, inspection, cleaning, maintenance and storage of protective equipment, when required,
 - instruction and training in the correct use and maintenance of the equipment,
 - for respirators, medical assessment of respirator wearers, when required,
 - documentation when required, and
 - An annual review that
 - assesses exposure control measures to ensure their continued effectiveness,
 - determines the need for further control,
 - ensures the adequacy of instruction, and
 - for respirators, assess the adequacy of exposure monitoring data and assess the need for further monitoring, and ensure the adequacy of the fit test program.

Instruction

• The employer must ensure that a worker who wears personal protective equipment is adequately instructed in the correct use, limitations and assigned maintenance duties for the equipment to be used.
Supervisor's responsibilities

- The supervisor must ensure that appropriate personal protective equipment is
 - available to workers,
 - properly worn when required, and
 - properly cleaned, inspected, maintained and stored.

Worker's responsibilities

- A worker who is required to use personal protective equipment must
 - use the equipment in accordance with training and instruction,
 - inspect the equipment before use,
 - refrain from wearing protective equipment outside of the work area where it is required if to do so would constitute a hazard, and
 - report any equipment malfunction to the supervisor or employer.
- A worker who is assigned responsibility for cleaning, maintaining or storing personal protective equipment must do so in accordance with training and instruction provided.

For more information on

OHS Regulation Part 8: Personal Protective Clothing and Equipment Refer to the WorkSafeBC website.

https://www.worksafebc.com/en/law-policy/occupational-healthsafety/searchable-ohs-regulation Part 34: Rope Access

This Part is beyond the scope of this course.

The following is a brief overview of the training requirements:

34.4 Training and certification

(1) Before allowing a person to perform rope access, the employer must ensure and document that the person

(a) has received training in the safe use of a rope access system, including, as appropriate to the work being done, the safe work practices, skills and practical experience hours described in one of the following groups of publications:

(i) International Code of Practice (2013) and General requirements for certification of personnel engaged in industrial rope access methods, Edition 6 (June 2009), published by the Industrial Rope Access Trade Association;

(ii) Safe Practices for Rope Access Work (August 2012) and Certification Requirements for Rope Access Work(November 2012), published by the Society of Professional Rope Access Technicians;

(iii) Scope of Practice (2012), Technical Handbook for Professional Mountain Guides (1999) and Climbing Gym Instructor Technical Manual (2003), published by the Association of Canadian Mountain Guides;

(iv) *Cave Guiding Standards for British Columbia and Alberta* (January 2004), published by the Canadian Cave Conservancy, and *Companion Rescue Workshop* (2011), published by British Columbia Cave Rescue, and

(b) holds a valid certificate of the training referred to in paragraph (a) issued by a body or association referred to in subparagraphs (i) to (iv) of that paragraph.

(2) The certificate referred to in subsection (1)(b) must be available at the workplace and produced for inspection on the request of an officer.

(3) Before allowing a person to perform rope access, the employer must ensure and document that the person is trained in the rope access plan and knows that person's duties under the plan.

Chapter 2 Exercise:

5. True or False?

A person must not carry out or cause to be carried out any work process or operate or cause to be operated any tool, appliance or equipment if that person has reasonable cause to believe that to do so would create an undue hazard to the health and safety of any person.

6. True or False?

The employer must develop and implement a written procedure for checking the wellbeing of a worker assigned to work alone or in isolation.

7 Which of the following must be maintained in a state of good repair and kept free of slipping and tripping hazards?

- (a) Floors and Platforms
- (b) Ramps and Stairs
- (c) Walkways
- (d) All of the above

Summary

What was covered in Chapter 2?

- Regulations and applicable orders that relate to general safety duties.
- How to find current regulations and applicable orders that relate to fall protection.
- Rights and responsibilities with respect to refusing unsafe work.
- Rights and responsibilities with respect to working alone.

Chapter 3: Fall Protection Situational Awareness

Workers must be able to evaluate the elements of the environment they are working in, understand the situation, and be able to decide the best approach to ensure their safety while working in area with fall hazards.

Workers must be trained in the safe use of the fall protection system before working in an area where a fall protection system must be used. Workers also need to be able to determine under what circumstances fall protection is required and which fall protection system is most suitable for each situation. Know when a fall protection plan is required and be aware of the requirements of fall protection plans.

Goal: Ensure that the student has a situation awareness of fall protection.

Objectives:

1. The student will be able to assess a situation where fall protection is required.

2. The student will be able to determine the most appropriate fall protection system to be used in different situations.

3. The student will be able to identify when a fall protection plan is required.

4. The student will be able to list the specific information that is required in a fall protection plan.

Watch Video – CCTV footage of a worker falling from a ladder in a mall. Viewer Discretion is Advised

What is your working knowledge Of Fall Protection?

Discussion

OHS Regulation Part 11: Fall Protection

Definitions

"fall arrest system" means a system that will stop a worker's fall before the worker hits the surface below;

"fall protection system" means

(a) a fall restraint system,

(b) a fall arrest system, or

(c) work procedures that are acceptable to the Board and minimize the risk of injury to a worker from a fall;

"fall restraint system" means a system to prevent a worker from falling from a work position, or from travelling to an unguarded edge from which the worker could fall;

"full body harness" means a body support device consisting of connected straps designed to distribute the force resulting from a fall over at least the thigh, shoulders and pelvis, with provision for attaching a lanyard, lifeline or other components;

"horizontal lifeline system" means a system composed of a synthetic or wire rope, installed horizontally between 2 anchors, to which a worker attaches a personal fall protection system;

"lanyard" means a flexible line of webbing, or synthetic or wire rope, that is used to secure a safety belt or full body harness to a lifeline or anchor;

"lifeline" means a synthetic or wire rope, rigged from one or more anchors, to which a worker's lanyard or other part of a personal fall protection system is attached;

"personal fall protection system" means a worker's fall restraint system or fall arrest system composed of

(a) a safety belt or full body harness, and

(b) a lanyard, lifeline and any other connecting equipment individual to the worker that is used to secure the worker to an anchor, an anchorage or a horizontal lifeline system;

"safety belt" means a body support device consisting of a strap with a means for securing it about the waist and attaching it to other components;

Obligation to use fall protection

Unless elsewhere provided for in this Regulation, an employer must ensure that a fall protection system is used when work is being done at a place

- from which a fall of 3 m (10 ft) or more may occur, or
- where a fall from a height of less than 3 m involves a risk of injury greater than the risk of injury from the impact on a flat surface (**Unusual possibility of Injury**).
 - The three-metre fall distance is measured from the point on the platform, stair, working surface etc. from which a worker may fall.

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.

Calculation of Fall Distance When on a Sloped Roof

- At a minimum, this will be the distance from the bottom edge of the roof to the next safe lower surface or ground below.
- The vertical distance from the worker's position to the unguarded roof edge should be added when on a roof with a slope greater than 4 vertical in 12 horizontal.

Part 20. Construction, Excavation and Demolition

Fall protection systems suitable for each type of roof

Fall Protection on Roofs Up to and Including 4 / 12 Slope



Control Zone and Safety Monitor Systems

Are Not to be Used on Roofs Steeper Than 4 vertical to 12 horizontal.

Fall Protection on Roofs > 4 / 12 but < 8 / 12 Slope

- Guardrails
- Personal fall protection systems
- Safety nets
- Other acceptable work procedures



Toe Holds and Personal Fall Protection Systems, or Safety Nets

If toe holds are not possible workers should use appropriate roof ladders or acceptable work platforms in conjunction with a personal fall protection system.



Toe-holds and Roof Jacks

The attachment will need to be suitable for the roof and the application, provide safe footing, and be able to withstand any forces likely to be imposed on it.

Toe-holds are properly oriented with the 6-inch side perpendicular to the roof. Attachment of toeholds to the roof will typically be accomplished by using manufactured roof jacks according to the manufacturer's instructions.

Toe-holds are intended for worker positioning and are not to be used for the purpose of storing any material other than what is reasonably required to complete the work at hand.



Another method may be to construct an "L" using a 2x4 and 2x6 and securely fastening this L to the roof, as illustrated below.



Toe-nailing a 2x6 to the roof is not an acceptable method of securing toe-holds.

The attachment will need to be suitable for the roof and the application.

Provide safe footing and be able to withstand any forces likely to be imposed on it.

Fall Hazard Area

Several terms are used to describe the place from which a person could fall or is working for example:

- "employed on a roof"
- "the worker's position"
- "when work is being done at a place"

These all describe what is referred to as "fall hazard area".

Factors That Determine the Fall Hazard Area

The employer is responsible for determining the fall hazard area (i.e., the safe distance from the unguarded edge).

Some of the factors that the employer will need to take into consideration include, but are not limited to, the following:

- The nature of the work to be conducted
- The hazards that are present in the workplace
- Environmental conditions, such as temperature, ice, rain, or heavy winds
- Whether the work is carried out at an elevation relative to the unguarded edge (e.g., working on an air-handling unit from a ladder)
- Whether the risk is increased using tools or other equipment in the work area.

Flat or Low Sloped Work Surfaces

- In the case of flat or low-sloped work surfaces (not exceeding 4 vertical to 12 horizontal or (4/12), that distance will be at least 2 metres (6.5 feet) from the unguarded edge.
- Once the fall hazard area has been determined, assessed and hazard controls put in place, the most suitable fall protection system can be determined, using the hierarchy of fall protections systems.

Selection of Fall Protection Systems

It is important to emphasize that elimination of a hazard is the first obligation.

- However, when elimination of the hazard is not possible the most appropriate fall protection must be used.
- The fall protection system with the least risk that allows the worker to perform their task will be the most appropriate but may not be practicable.

Hierarchy of Fall Protection



• Guardrails

The employer must ensure that guardrails meeting the requirements of Part 4 (General Conditions) or other similar means of fall restraint are used when practicable.

• Fall Restraint

If guardrails are not practicable, the employer must ensure that another fall restraint system is used.

• Fall Arrest

If fall restraint is not practicable, the employer must ensure that one of the following is used:

(a) a fall arrest system;

(b) a rope access system that meets the requirements of Part 34. *Note: As discussed earlier, Part 34. Rope Access System is beyond the scope of this training program.*

• Procedures

If fall arrest or a rope access system are not practicable, or will result in a hazard greater than if a fall arrest system or a rope access system was not used, the employer must ensure that work procedures are followed that are acceptable to the Board and minimize the risk of injury to a worker from a fall.

Acceptable procedures include but may not be limited to:

- Control Zone
- Safety Monitor.

Before a worker is allowed into an area where a risk of falling exists, the employer must ensure that the worker is instructed in the fall protection system for the area and the procedures to be followed.

Safety Nets and Guardrails

Safety nets and guardrails are shared systems.

Both, safety nets and guardrails must meet all required regulations and standards

Removal of Guardrails

- When necessary to remove a guardrail to accommodate work only that portion of the guardrail necessary to allow the work to be done may be removed (Section 4.58.1 OHS Regulation).
- Workers exposed to a fall hazard must be protected by another fall protection system when the guardrail is absent.
- The guardrail must be replaced when the unguarded area is left unattended, and after the work is completed if the circumstances still require guardrails.

Guardrails - Administrative Controls

Write down 3 rules about using guardrails that you are familiar with.

1	 		
2.			
3			
0			

Fall Restraint

- Fall restraint normally means a fall protection system arranged such that a worker cannot fall lower than the surface on which the worker was supported before the fall started.
- A personal fall restraint system for a worker on an elevated flat surface would be arranged so the worker could go up to the edge of the work surface, but not beyond the edge in the event of a slip or fall.
- The system, in the event of a slip or fall, would result in the worker landing on the work surface, and perhaps very close to going over the edge.
- A fall restraint system should only be used where a worker likely can regain footing or otherwise self-rescue immediately after a slip or fall.
- Fall protection equipment and components that are intended only for fall restraint applications should be clearly and permanently marked to indicate such a limitation.

Fall Restraint or Fall Arrest

- If the equipment cannot be arranged to limit the vertical drop to 30 cm, then the personal fall protection system should be a fall arrest type, and the system will need to address the additional requirements for fall arrest.
 - For example, section 11.4(1) of the *Regulation* requires workers to wear a full body harness or other harness acceptable to WorkSafeBC when using a personal fall protection system for fall arrest.
 - Further, the anchor the worker is connected to must meet the requirements of section 11.6(3) of the Regulation.

Fall Arrest

The most common form of fall arrest in the workplace is the Personal Fall Arrest System, or PFAS ("lifeline").

- Unlike Guardrails, Control Zones, and Fall Restraint a Personal Fall Arrest system will allow a worker to fall.
- There are five critical components of a fall arrest system.
- If one component fails, the entire system fails.

5 Critical Components of Personal Fall Arrest



- B Body Wear (full Body harness)
- C Connector (lanyard)
- **D** Deceleration Device
- E Emergency Response Plan



Application

- Installation or removal of fall protection equipment.
- Light duty work for short duration.
- Roof inspection or estimation.
- Transfers between fall protection systems.
- Work requiring constant repositioning.
- Workers on roofs engaged in a process that may damage lifelines.
- Use of the normal fall protection methods results in greater hazard
- Installation or removal of fall protection equipment.
 First up, last down principal.
- Light duty work for short duration.

Defining Light Duty and Short Duration

The use of a ladder may be acceptable for certain "light duty" tasks, as long as the work is completed under certain circumstances:

Working off of a portable ladder doing a "light duty task," such as an inspection or painting, where the ladder will be set up with its base at the same physical location for sporadic, short-term work.

Some examples of sporadic short-term work include the following: inspecting exterior vents, gutters, and window seals; caulking; touch-up painting; and maintenance-type work (such as changing light bulbs).

While performing the task, the worker should keep his/her centre of gravity (worker's waist) between the side rails of the ladder and should generally have one hand available to hold on to the ladder or other support to maintain three points of contact.

The ladder is not to be positioned near an edge, drop in height or floor opening that would significantly increase the potential fall distance. (Note that if the work on a ladder is likely to exceed 15 minutes at one physical location, some form of fall restraint or fall arrest protection should be used.)

Defining Light Duty and Short Duration (continued)

Where terrain and accessibility allow for other means of performing the work (e.g., a scissor lift or movable work platform), the use of other such means is to be considered prior to completing the work from a portable ladder.

Where work duration is approximately 15 minutes or less and the tasks are "light duty," the work may be completed from a portable ladder where use of a work platform is not practicable.

In circumstances where frequent ladder movement is required to complete multiple short duration tasks, each task may be considered as a separate instance of "short duration" work (e.g., light work such as touch-up painting at a residential dwelling may require multiple set-ups at various locations, and exceeding a total of 15 minutes for such a project is acceptable.

The total duration of the entire job should also be considered in determining situations where other work safety measures should be used (e.g., work to be completed at a specific site over the course of several days may not be considered as "short duration," depending on the specific circumstances at the time.)

• Roof inspection or estimation.

Provided the worker minimizes exposure to any unguarded edge as much as possible and provided other factors such as environmental conditions (e.g., wind or ice), roof slope, and surface finish do not present an undue hazard.

- Transfers between fall protection systems.
 Brief transfers between fall protection systems where the worker is protected by having a three-point contact (two feet placed firmly on a suitable supporting surface along with one hand supporting the worker, while the other hand is used to transfer a connection from one fall protection system to another).
- Work requiring constant repositioning.

For example, during the primary connection of skeletal structures, workers employed in the initial placement of skeletal members requiring climbing and walking on the bare structure may, depending on the particulars of the work to be done, be covered by section 11.2(5). Trades with activities of this nature typically include scaffold erectors, tower erectors, blowpipe ventilation erectors, structural steel erectors, and tower crane erectors. Workers on the structure engaged in welding, bolt installing, other fitting out work, and climbing or walking on skeletal members should be able to use the fall protection methods referred to in sections 11.2(2), (3), and (4).

- Workers on roofs engaged in a process that may damage lifelines.
 For example, workers doing roofing tar work (such as hot bitumen application on flat roofs), may have to work under the protection of work procedures under section 11.2(5), such as control zones and the safety monitor system.
- Use of the normal fall protection methods results in greater hazard For example, in emergencies such as the correction of an unsafe condition or in firefighting.

OHS Accepted Fall Protection Procedures

Safety Monitor System

• "Safety monitor system" means a system in which a trained worker is designated to monitor work activities in a control zone to ensure that work is done in a manner that minimizes the potential for a worker to fall.

Control Zone

• "Control zone" means the area between an unguarded edge of a building or structure and a safe work area.

Safety Monitor System

- A safety monitor system may be used as the means of fall protection where it is not practicable to use a method of fall restraint, fall arrest, or rope access; or where the use of a fall arrest or rope access system will result in a greater hazard.
- The safety monitor system is intended for level or low-sloped work surfaces, it is not to be used on a working surface where the slope of that surface exceeds 4 vertical to 12 horizontal (4/12), for skeletal structure work, or for scaffold erection and removal.

A safety monitor will:

- Be experienced in the work overseen and trained in the role of safety monitor
- Be present at all times when a worker is in the control zone
- Have complete authority over the work as it relates to the prevention of falls
- Engage in no other duties while acting as the safety monitor
- Be positioned to have a clear and continuous view of the work
- Also, a safety monitor will:
- Be able to have normal voice communication with the workers being protected
- Monitor no more than eight workers
- Be instantly distinguishable from other workers

The written fall protection plan for the workplace (required by section 11.3) will specify the name of each safety monitor.

Control Zone

- "Control zone" means the area between an unguarded edge of a building or structure and a safe work area.
- The width of a control zone is to be at least 2 metres (6.5 ft), with additional distance if any of the following conditions exist:
 - The working surface is slippery or sloped
 - The work is carried out at an elevation relative to the unguarded edge (e.g., working on an air-handling unit from a ladder)
 - The risk is increased by the use of tools or other equipment near the control zone
 - The risk is increased by environmental conditions such as ice, rain, or heavy winds
- A line defining the control zone is to be established along the internal edge of the control zone by a raised warning line or other equally effective means at all times during such work. For example, an acceptable raised warning line includes a line with both of the following:
- A high-visibility material, or a line flagged or clearly marked with high-visibility materials at intervals not exceeding 2 metres (6.5 ft).
- Rigged and maintained to be between 0.85 metres and 1.15 metres (34 and 45 inches) above the working surface.
- For clarification purposes, a raised warning line is only required when the safety monitor system will be used as the means of fall protection under section 11.2(5).
- A raised warning line is not required when other methods of fall protection are used, such as fall restraint. However, an employer may choose to use a raised warning line to increase the workers' awareness of the fall hazard area.
- If workers will at all times remain further from the unguarded edge than the width of the control zone, no safety monitor or other fall protection system is required.
- Only workers directly required for the work at hand will be inside the control zone.

Control Zone Using A Safety Monitor

- On a narrow roof, such as one less than 12 metres (40 ft) wide, an employer may proceed with a safety monitor system without using a raised warning line by declaring the entire work surface the control zone. This will be specifically noted in the fall protection plan.
 - The role of the safety monitor is to ensure that the work activity in the control zone is performed in accordance with the fall protection plan and in a manner that minimizes the potential for a worker to fall.
 - The safety monitor will be positioned in a safe location and have a clear view of the work.

Procedures may be developed and used in place of fall protection equipment, if it is not reasonably practicable to use one of the other fall protection systems.



Additional Considerations:

- The frequency with which a ladder is being used at a site (overly frequent use may indicate that other means of completing the work are more appropriate)
- The duration of use at a site (if length of use tends toward longer periods of use, other means should be considered where practicable).
- The overall practicability of using other work platforms to complete use (e.g., scissor lifts, boom lifts, scaffolding, etc.)
- Work done from a ladder must be done in full compliance with Part 13 of the *Regulation* (especially Division 2 Ladders, including sections 13.4, 13.5, and 13.6). Section 13.6(1) of the *Regulation* states that "if work cannot be done from a ladder without hazard to a worker, a work platform must be provided." If the work cannot be completed in full compliance with the requirements for safe ladder use under Part 13 a ladder must not be used for that work.

Hierarchy of Fall Protection - Summary

Not withstanding the requirements for each of the options, they are in order of priority based upon risk. The least risky option is to eliminate the hazard, followed by:

- Guardrails
- Fall Restraint
- Personal Fall Arrest
- Procedures

Fall Protection Plan

A written fall protection plan for a workplace is required when:

- Work is being done at a location where workers are not protected by permanent guardrails, and from which a fall of 7.5 m (25 ft) or more may occur, or
- Work procedures are being used in place of one of the other fall protection systems

Elements of a Fall Protection Plan

The fall protection plan must be available at the workplace before work with a risk of falling begins, and include the following elements:

- The fall hazards expected in each work area
- The fall protection system or systems to be used in each area
- The procedures to assemble, maintain, inspect, use, and disassemble the fall protection system or systems
- The inspection requirements for the anchors and anchorage used and the respective rejection criteria as per section 11.10 (To be discussed in Chapter4-Equipment and Chapter 6-Anchors).
- The procedures for rescue of a worker who has fallen and is suspended by a personal fall protection system or safety net but is unable to self-rescue.

Additional Considerations

In certain locations and situations, the employer may meet the need for rescue procedures by participating in the Industrial High Angle Rope Rescue Program.

Also, where a fall protection plan may not be required by the Regulation, the employer must still consider the need for rescue or evacuation.

Chapter 3: Exercise

- 8. In accordance to OHS Regulations, a fall protection system is required when?
- (a) A fall of 3 meters (~10 ft) or more may occur.
- (b) A fall of 3ft may occur (~1m)
- (c) There is a risk of injury greater than the risk of injury from the impact on a flat surface.
- (d) Both (a) and (c) are correct.
- 9. Which of the following has fall protection systems in order from lowest to highest risk?
- (a) personal fall arrest, guardrails, fall restraint, procedures
- (b) fall restraint, guardrails, personal fall arrest, procedures
- (c) guardrails, fall restraint, personal fall arrest, procedures
- (d) guardrails, personal fall arrest, fall restraint, procedures

10. True or False?

A fall protection plan is required when guardrails are not being used and a worker may fall a distance of 7.m (~25ft) or more.

11. True or False?

A fall protection plan is required when procedures are being used in place of fall protection equipment.

Summary:

What was covered in Chapter 3?

- How to assess a situation where fall protection is required.
- How to select the most appropriate fall protection system.
- Identifying when a fall protection plan is required.
- Information that is required in a fall protection plan.

Chapter 4: Equipment

Goal: The student will understand the advantages, disadvantages, limitations, hazards, and importance of inspections associated with various fall protection components and equipment used in fall protection.

Objectives:

1. The student will know when it is appropriate to use a harness or belt.

2. The student will be familiar with various lanyards used in fall protection systems.

3. The student will know the elements that contribute to arrest force, and how to limit the arrest forces experienced in a fall.

4. The student will be familiar with types of equipment used in fall protection systems

5. The student will be familiar with equipment standards.

6. The student will understand the need to follow equipment manufacturers' instructions when conducting an inspection.

7. The student will understand the importance of preventing damage to their equipment.

8. The student will know how to identify obvious signs of damage, and the importance of manufacturers' inspections.

9. The student will know when equipment needs to be removed from service and what measures can be taken with equipment when it has been removed from service.

Selection of Harness or belt

This is a brief overview of the regulatory requirements regarding Harnesses and Belts. The full body harness will be covered in detail in Chapter 8.

- A worker must wear a full body harness or other harness acceptable to the Board when using a personal fall protection system for fall arrest.
- A worker must wear a safety belt, a full body harness or other harness acceptable to the Board when using a personal fall protection system for fall restraint.

Body Belts

Belts should not be used as body support in a fall arrest system due to the possibility of death or injury from the following causes:

- slipping out of a belt;
- abdominal injuries;
- back injuries; or
- effects on the body of extended static suspension in a belt

Is there a difference between being legal and being safe?

- Full body Harnesses Main Functions:
 - to securely hold the worker's body during free fall, deceleration and final arrest;
 - 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;
 - to keep the body in an upright or near upright position after the fall and until the worker is rescued; and
 - 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 suitable for fall arrest.
- Sit harnesses commonly used in mountaineering are unacceptable.
- Only full body harnesses approved to CSA or ANSI standards are acceptable.

Lanyards

- A lanyard is a flexible line of webbing or synthetic or wire rope that is used to secure a full body harness or safety belt to a lifeline or anchor point.
- There are different types of lanyards; Elastic, Twin Leg, Adjustable, and lanyards designed to be tied-back on itself (Chokered).
- Lanyards can be made of various materials each with their own attributes making each one more desirable for use in different environments.



Non-Adjustable Lanyard With Energy Absorber



Non-Adjustable Twin-Leg Lanyard With Energy Absorber



Elastic Lanyard with Energy Absorber



Adjustable lanyard with Energy Absorber



With Energy Absorber

Rope Lanyard Without Energy Absorber

Wire Rope Lanyards

- When working in areas with hazards such as a tool or corrosive agent that could sever, abrade, or burn a lanyard the worker might choose a lanyard that is made of wire rope or other material appropriate to the is used in the work area.
- However, if a worker works near an energized conductor or in a work area where a lanyard made of conductive material cannot be used safely, another type of lanyard or possibly a different fall protection system would have to be used.
- 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.
- Never place a snap-hook directly through the thimble eyes of a wire rope.
- In the absence of an O Ring, a carabiner that is compatible with the snap-hook must be used.



A system using a wire-rope lanyard <u>must</u> incorporate an energy absorber.

Chokering / Tie Back

Tying equipment back on itself (Chokering) affects the overall strength and must not be done unless the manufacturer specifically states that it is specifically designed for that type of use.





Lanyard Length

• The lanyard length must be as short as possible for the work involved yet allow reasonable maneuverability and working convenience.

Allowable Free Fall

- WITHOUT an energy absorber;
 the free fall distance must not exceed 4ft.
- WITH an energy absorber;
 the maximum allowed free fall distance is determined by the manufacturer.
- The only fall arrest system in which an energy absorber or energy absorbing lanyard is not desired is one in which the added fall distance created by the energy absorber fully extending creates a greater risk of injury than if the energy absorber were not used.
- An energy absorber should not be used where this added distance could result in worker injury. However, allowable free fall distances or arrest forces can not be exceeded.

A self-retracting device limits the fall distance and may be the best choice in situations with reduced clearance distance.

Daisy Chaining (Connecting two lanyards together)

- 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.

Maximum Arrest Force (MAF)

- 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.
- Arrest force is determined by:
 - the weight of the worker,
 - the distance of the free fall, and
 - ability of the fall arrest system to absorb the energy associated with the fall.

You can reduce injuries by reducing the arrest force.

- WorkSafeBC accepts a Maximum Arresting Force (MAF) of 8 kN (1800 lb) as the high limit for arrest force due to the fact that under worst case conditions (a wet and then frozen energy absorber), the MAF can be as great as 8 kN (1800 lb) for a type E6 energy absorber.
- Lower MAF is technically achievable with today's fall protection equipment and the lower MAF means that workers are exposed to a lower arresting force, reducing the potential for injury.

Energy Absorbers

- To arrest a fall in a controlled manner, it is essential that there is sufficient energy absorption capacity in the system.
- Without this designed energy absorption, the fall can only be arrested by applying large forces to the worker and to the anchorage, which can result in either or both being severely affected.
- An energy absorber is a device intended to reduce the force on a worker when a personal fall arrest system is operating;
- The energy absorber must always be attached to the D-Ring.
- A lanyard incorporating an energy absorber may be used for Fall Restraint as it takes considerable force e.g. approximately 600 lbs, before the energy absorber's stitching begins to release.
- A personal fall arrest system consists of a full body harness and a lanyard equipped with an energy absorber or similar device.

Energy Absorber Categories

CSA Standard creates two categories of energy absorber known as E4 and E6.

Category	Weight Range	Maximum Arrest Force
E4	45-115 kg (100-254 lbs)	4 kN (900 lb) dry 6 kN (1350 lb) wet and frozen
E6	90-175 kg (200-386 lbs).	6 kN (1350 lb) dry 8 kN (1800 lb) wet and frozen

CSA created the two ratings to better protect workers of different body weights

- In the case of a heavy worker, an E4 energy 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 energy absorber.

NEW

In January 2017 CSA eliminated Class E4 and E6 energy absorber.

- Existing Class E4 and E6 energy absorbers may continue to be used until the end of their life.
- Energy absorbers manufactured to meet the January 2017 CSA Standard will have a weight range, maximum free fall distance and maximum deployment.
- Calculations will need to be made to predict the deployment distance.
Allowable Arrest Force Is Safe When:

- 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 (1350 lb) limit is therefore considered safe, but as was discovered during the studies, is subject to the following conditions:
 - the maximum arresting force is applied upwards through the pelvic area;
 - the worker's physical condition is sufficient to withstand such a jolt; and
 - the duration of the maximum arresting force is limited to a fraction of a second.



Keep in mind that 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 8 kN (1800lbs) could be exceeded. And therefore, employers and workers must ensure the maximum arresting force to which a worker can be exposed during fall arrest does not exceed 8 kN (1800lbs).

Deployment Distance and Clearance

Always include the deployment distance of your energy absorber when calculating clearance requirement.

E4 deploys 4ft. E6 Deploys 6ft.



Know Your Equipment

- Only use equipment for the purpose for which it was designed.
- Always follow the manufacturers' instructions for the proper use of equipment.
- Unless stated otherwise in the manufacturers' instructions, assume the equipment is designed to be used by only one worker at a time.
- Ensure equipment components are compatible.
- Ensure equipment is compatible with the hazards and environment.
- Protect your equipment from hazards such as; sharp edges, corrosive material, rough edges, moving equipment, excessive heat, electrical hazards.

Watch Video – ARREST FORCES

Carabiners and Snap-Hooks

- Must be self-closing and self-locking,
- May only be opened by at least two consecutive deliberate manual actions, and
- Must be marked with
 - its breaking strength in the major axis, and
 - the name or trademark of the manufacturer.

Equipment used to interconnect the components of a personal fall arrest system are subjected to the full maximum arresting force developed during a fall and must meet applicable standards.

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.



© SAGA Universal Training Corp 2019

Hazards Associated with Connecting Equipment

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.

Roll-out & Forced Roll-out

- 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.

Non-locking or Manual Locking Snap Hooks / Carabiners

- Although no manufacturer in North America or Europe uses non-locking snap hooks anymore, thousands of them may still be in service.
- This equipment MUST BE REMOVED from use and storage if it is used or could be used for fall protection.

Snap-hooks and Carabiners should never be positioned where arrest forces may be placed upon the gate.

Locking snap-hooks DO NOT "eliminate" forced roll-out.

Only proper orientation and compatibility of equipment will ensure a safe connection. Example of accidental roll-out of a snap hook



Improper or Incomplete Connection (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



Example of improper or incomplete connection



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.



 Connections between hardware components must be made carefully when using snap hooks and especially carabiners.

Controlling Hazards Associated with Connecting Equipment

- Ensure equipment meets required standards.
- Follow manufacturer's instructions for proper selection, use, maintenance, and inspections.
- Only use equipment that is compatible with other components.
- Only use equipment that is compatible with the hazards and environment it maybe exposed to.
- Ensure you are competent in the use of all equipment you use.

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.

Example of a fall arrester in use







- Typical users include window washers suspended from swing-stages and in growing numbers, workers climbing tall ladders
- 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.

Fall Arresters Compatibility & Proper Orientation

- Must be compatible with the rope / cable.
- Must be properly oriented on the rope / cable.

It is important to recognize that no fall arrester can safely be used on every life safety rope.

A sliding hitch knot or other system incorporating a knot is not a fall arrester

In general, there are two classes of fall arrester, Manual & Automatic Fall Arresters

Manual Fall Arresters

- Manual Fall Arresters are the simplest type. They are well suited to positioning systems on sloped roofs or Fall 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 Fall Restraint, the worker needs to correctly position the device on the life safety rope so that it is impossible to reach an unprotected edge.



Automatic Fall Arresters

- 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 (~4.5 ft.) 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.

Additional Fall Distance Using Fall Arresters

- 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.

Self-Retracting Device

- A self-retracting device (SRD) is a fall arrest device that performs a tethering function while allowing vertical movement (below the device) to the maximum working length of the device
- SRDs are designed to arrest a fall while minimizing fall distance and impact force.
- 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.
- Standards require that Type 2 and Type 3 SRDs be inspected two years after being placed into service, and annually thereafter.
- Because it is the only standard known to require such follow-up maintenance, it is the only standard listed in this section.

The self-retracting device must:

- Be anchored above the worker's head unless the manufacturer's specifications allow the use of a different anchor location.
- Be used in a manner that minimizes the hazards of swinging and limits the swing drop distance to 1.2 metres(~4 ft.) if a worker falls.

Although not required, Type 1 SRD <u>should</u> be used with a separate shock absorber if it is not already equipped with an integral shock absorber.



Self Retracting Devices and CSA classifications and Requirements

Type 1 Self-Retracting Device (SRD)

- This is a compact and lightweight SRD having a working length of 1.5 to 3.0 metres
- (~5 to ~10 ft.).
- 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.
- 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, unless otherwise stated in the manufacturer's instructions.

Type 2 Self-Retracting Device (SRD)

- This is a heavier SRD sometimes referred to as a self-retracting lifeline, generally having a working length of more than 3 metres (~10 ft.).
- It has an internal brake to minimize impact forces.
- The Type 2 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.

Type 3 Self-Retracting Device with Retrieval Capability (RSRD)

- Type 3 SRD's have all of the characteristics of a Type 2 device listed above.
- However, a Type 3 device incorporates a rescue winch that permits a single rescuer to raise or lower the victim to a safe level.

Self-Retracting Devices				
Туре	Length	Annual Inspection	Load Indicator / Arrest Indicator	Retrieval Function
Type 1	1.5 – 3.0m (~5 ft. to ~10 ft.)	Not mandatory	Not Mandatory	No
Type 2	> 3.0m (~10ft)	Required	Required	No
Type 3	> 3.0m (~10ft)	Required	Required	Yes



Like a standard lanyard, an SRD subjected to the force of a fall must be retired from service. Proper Use of Self Retracting Devices

- 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.
- 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.
- 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 an energy absorber positioned between the worker's D-ring and the free end of the SRD.
- Attach a tag line so the lanyard is not left exposed to the elements when not in use.

Read the Fine Print

Like equipment instructions, labels contain critical information for the proper use and possible hazards associated with the equipment.

Self-Retracting Devices and Fall Restraint systems

- Self-retracting devices must not be used in a Fall Restraint system unless the length of the lifeline on the drum of the unit prevents the worker from reaching the edge.
- In Fall Restraint, the worker needs to correctly position the system so that it is impossible to reach an unprotected edge.
- If a worker's movement cannot be adequately restricted by the Fall Restraint system, the worker must use a personal fall arrest system.

NEW

In January 2017 CSA established a new classification system for self retracting devices (Self Retracting Lifeline).

- SRL: self-retracting lifeline is higher than the D-ring on the worker.
- SRL-R: self-retracting lifeline is higher than the D-ring on the worker and also has a rescue device.
- SRL-LE: self-retracting lifeline is lower than the D-ring on the worker or the self-retracting lifeline can lean against a sharp edge (LE if for Leading Edge).
- SRL-LE-R: the self-retracting lifeline meets the SRL-LE standards and also has a rescue device.
- Inspection requirements based on use rather than time.

Know Your Equipment

- Equipment can have many variations.
- Workers must be familiar with the design purpose, limitations, and hazards associated with the equipment they are using.

Descent Control Device

For information only: This equipment requires specialized training NOT INCLUDED IN THIS COURSE

- 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.



Equipment Standards

Equipment used for a fall protection system must

- Consist of compatible and suitable components,
- Be sufficient to support the fall restraint or arrest forces, and
- Meet, and be used in accordance with, an applicable CSA or ANSI standard in effect when the equipment was manufactured, subject to any modification or upgrading considered necessary by the Board.
- Types of equipment that do not have applicable standards still must meet the above requirements.
- Under section 4.4 of the *Regulation*, WorkSafeBC can also recognize standards other than CSA or ANSI. Contact WorkSafeBC Prevention Practices and Quality to request acceptance of other standards.

Vertical lifelines

Factors to be considered when selecting vertical lifelines include the following:

- Compatibility with the other fall protection system components.
- Only one worker is to be attached to a lifeline, unless the vertical lifeline is used as part of a ladder safety device on a fixed ladder.
- The lifeline is to have a breaking strength specified by the manufacturer of at least 27 kN (6,000 lbs).
- The rope must be protected to prevent abrasion by sharp or rough edges.
- Must be made of material appropriate to the hazard and able to withstand adverse effects.
- Must be installed and used in a manner that minimizes the hazards of swinging and limits the swing-drop distance to 1.2 metres (~4 ft.) if a worker falls.

- The lifeline is to be free of knots or splices except at its termination. A termination knot or splice should not reduce the breaking strength of the lifeline to less than 22 kN (5,000 lbs).
- A vertical lifeline is to extend to within 1.2 metres (4 ft) of ground level or other safe lower surface to which the worker might descend or fall. The intent is to ensure that a worker on a suspended stage, such as a swing stage or boatswain's chair, can be secured to a lifeline through the full range of travel of the staging unit.

Note: In some circumstances it is not practicable or safe for the lifeline to extend to within 1.2 metres of the lower landing spot.

For example, if a stage is rigged over an underground parking entrance and the lower end of the rope were to come within 1.2 metres of the roadway, there would be a danger of the rope being caught by a vehicle, unless the use of the access was blocked. Blocking the access may not be practicable, in which case some means to terminate the lifeline rope at a safe distance above the danger area should be used. The stage should also be rigged to prevent it from being lowered into a zone where traffic could be a danger to the stage. A means to rescue workers also needs to be preplanned.

Life Safety Rope of Substantial Length

- Where vertical lifelines are of substantial length, particularly if more than 91 metres (300 ft), added consideration needs to be given to factors such as the elasticity of the line and the effects of wind loading.
- The longer the lifeline, the longer the total fall distance of a worker due to stretching of the line, with an increased risk that a worker may contact a hard surface before a fall is arrested. Use of lifelines with low elasticity will help control such risks.

Inspection and Maintenance

You can't inspect what you can't see.

- All load-bearing equipment must be 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.

Equipment Inspection Essentials

- Equipment used in a fall protection system must be:
 - Inspected by a qualified person before use on each workshift.
 - Kept free from substances and conditions that could contribute to its deterioration.
 - Maintained in good working order.
 - Recertified as specified by the manufacturer.
- It is important to inspect personal fall protection equipment on an ongoing basis to ensure safety.
- At minimum this involves inspection before use on each work shift, and after each use to arrest a fall.
- It is also recommended to inspect equipment just before each use if not already covered by one of the other inspection scenarios.
- Inspections must be done in accordance with manufacturer instructions, if available, and in conformity with any standards which apply to the equipment.

Manufacturer's Inspection

- In addition to the inspection required before each use the equipment must be inspected as required by the manufacturer.
- Most manufacturers require fall protection equipment to be inspected on a regular basis not to exce85ed one year, or more frequently, by a competent person (as defined by the equipment manufacturer), to verify that the equipment is safe for use.

This Page Left Blank Intentionally Elements of a Visual Inspection (always follow the manufacturer's instructions)

- Date of manufacture, if it meets the requirements of the manufacturer proceed with the remainder of the inspection. The age of the equipment exceeds manufacturer specifications. For example, one supplier has specified a maximum 2 years of use beyond the date of manufacture. Note: If equipment exceeds a specified use life, as an alternative to removal from service, the user may wish to contact the manufacturer to see if the harness could be submitted for possible recertification.
- Missing or illegible tags.
- Missing keepers or anything that might affect the equipment fit / function.
- Check all equipment for any alterations.
- Integrity of stitching throughout the equipment, on both outer and inner surfaces
- Signs of deformation, bunching, or deterioration of pick points.
- Signs of contact with chemicals.
- Signs of any equipment being cut, stretched, frayed, or otherwise damaged.
- Integrity of shackles and straps.
- Signs of exposure to ultra-violet light.
- Signs of exposure to high temperatures (above 200 degrees F (93 degrees C), or other temperature specified by the manufacturer. Note: The specified temperature is just below the boiling point of water.
- All materials for any sign of deformation, wear, stretching, cracks, or kinking.
- All metal and other materials for any signs of corrosion or other chemical deterioration.
- All lines for wear on surfaces, and any potential or actual fraying, kinking, bird caging, heat fusion, or other damage.
- Check webbing and ropes for heat damage (burns, friction, welding arcs, sparks) fraying, un-splicing, kinks, knots, broken stitching, cuts, excessive abrasion, excessive oil or grease contamination, discoloration.
- Moveable parts to ensure proper action, and the capability of all locking and other immobilizing devices to perform their function.

Maintenance

Equipment used as part of a fall protection system must be:

- Kept free from substances and conditions that could contribute to deterioration of the equipment, and
- Re-certified as specified by the manufacturer.

Preventing Damage

- Prevent damage to your equipment by understanding the hazards you may be working with, and how those hazards may damage your equipment.
- Exposure to greases and oils: Nylon and polyester have different attributes that can make them suitable or unsuitable for exposure to greases and oils.
- Exposure to Ultra-Violet light: Sun, lighting, welding arcs, can cause damage that may be difficult to see, but can be detected by touch.
- Sharp Edges and Chemicals: Keep your equipment away from, or protect it from damage by coming into contact with sharp edges and chemicals.
- Mildew and Rust: Don't put your equipment away wet, mildew can damage webbing and rust can damage metal components.
- Put your equipment away and store it properly.

Removal from Service Protocol

There are three primary reasons why equipment must be removed from service

- 1. Used in A Fall After a fall protection system has arrested the fall of a worker, it must be removed from service, and not be returned to service until it has been inspected and recertified as safe for use by the manufacturer or its authorized agent, or by a professional engineer.
- 2. Fail an Inspection Any equipment that fails an inspection must be removed from service until it has been inspected and recertified as safe for use by the manufacturer or its authorized agent, or by a professional engineer.
- 3. Required by Manufacturer Instructions or Standards If the condition of the equipment or exposure to a hazard identified by the manufacturer or applicable standard to which the equipment is manufactured would otherwise require removal, it must be removed from service.
- Any component removed from service for cause should either be disposed of in such a manner that it cannot accidentally be re-used or must be identified in a manner that will ensure it is not used until repairs are complete and it is safe for further use.

Stunt Work Exemption

- The removal from service protocol does not apply to a personal fall protection system designed and intended for reuse by a performer in the entertainment industry for conducting a planned fall sequence.
- The following conditions must be met before a personal fall protection system will be exempt from:
 - The system must be designed and used in accordance with a standard acceptable to the Board;
 - Each use of the system must be carried out in accordance with the plan for the conduct of the fall.
 - The peak arrest forces generated in the system during each use must be at or below both the planned limits and the maximum forces allowed for the system.
- After each use of the system no part of the system, including the anchorage, may be reused until a qualified person has inspected it and determined it is in serviceable condition and safe for reuse.

Fall Protection used for stunt work is addressed in more detail in Chapter 7: Special Situations.

Equipment, The Bottom Line

Workers must be familiar with the:

- Design purpose
- Inspection requirements
- Advantages and Disadvantages
- Limitations
- Hazards

Associated with the equipment they use.

This Page Left Blank Intentionally Identify the defect and write it on the arrow in each of the following photos.





















Wear Bars?

Do not assume that different colored thread on webbing are "wear bars" or "wear indicators". They may be, or they may not. The equipment manufacturer should also provide instructions with respect to minor or major damage.



Equipment, The Bottom Line

Workers must be familiar with the...

- Design purpose,
- Inspection requirements,
- Advantages and Disadvantages
- Limitations
- Hazards

...associated with the equipment they use.

Chapter 4 Exercise

- 12. Full body harnesses:
- (a) are uncomfortable and not necessary.
- (b) 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.
- (c) keep the body in an upright or near upright position after the fall and until the worker is rescued.
- (d) b & c

13. True or False?

Equipment must be approved to required standards, and bear the markings of those standards.

14. Without an energy absorber; the free fall distance must not exceed.

- (a) 1.2 metres (~4ft.)
- (b) 3 metres (~10ft.)
- (c) 100 km/hr
- (d) the height of the worker

15. True or False?

The manufacturer's specifications should be consulted to determine the equipment's inspection and maintenance requirements.
16. Equipment used as part of a fall protection system must be.

(a) inspected by the worker as required by the manufacturer and before it is used on each work shift,

(b) pressure washed after every use.

(c) kept free from substances and conditions that could contribute to deterioration of the equipment, and

(d) a, c, & e

(e) re-certified as specified by the manufacturer.

17. Any equipment considered to be defective should be.

(a) sold to the new employee

(b) repaired by the most experienced worker

(c) thrown in the garbage.

(d) cut up, broken, or some other way made unusable before being disposed of.

Summary

What was covered in Chapter 4?

- Choosing a harness or belt.
- Lanyards used in fall protection systems.
- How equipment can affect arrest force.
- Equipment used in fall protection systems.
- Fall protection equipment standards.
- Importance of following equipment manufacturers' instructions when conducting an inspection and using equipment.
- Importance of preventing damage to equipment.
- Identifying obvious signs of damage, and the importance of manufacturers' inspections.
- Removal from service and steps to be taken with equipment when it has been removed from service.

Chapter 5: Special Hazards

Goal: The student will be able to reduce the risk of hazards associated with Clearance, Arrest force, Swing-fall / drop, and water hazards.

Objectives:

1. The student will be able to identify hazards associated with Clearance, Arrest force, Swing-fall, and water hazards.

2. The student will be able to evaluate the risk of hazards associated with Clearance, Arrest force, Swing-fall / drop, and water hazards.

3. The student will be able to list ways to reduce the risk of hazards associated with Clearance, Arrest force, Swing-fall / drop, and water hazards.

Clearance and Arrest Force

Clearance Distance

A personal fall arrest system must be arranged with enough clearance distance, including a safety margin, so that a worker cannot come into contact with:

- the ground, or a level below the work area, or
- an object or substance that poses an unusual possibility of injury,

Life Safety Rope vs. Self Retracting Devices

- In general, vertical life safety ropes require more clearance than self-retracting devices.
- Vertical life safety ropes should therefore only be used when large clearances are available.
- The most important consideration when using vertical life safety ropes is knowing how much clearance is required.

Factors Contributing to Required Clearance Distance

- Lock-off distance of the fall arrester,
- Lanyard length,
- Stretch of the vertical life safety rope,
- Swing-fall / drop,
- Deployment of the energy absorber
- Type of harness the worker is wearing

Arrest Force

A personal fall arrest system must limit the maximum arresting force on a worker to 6 Kn (1350 lb), unless the worker is using an E6 type energy absorber in accordance with the manufacturer's specifications, in which case the maximum arresting force must not exceed 8 Kn (1800 lb).

Factors Contributing to Arrest Force

- Free Fall Distance
 - "free fall distance" means the vertical distance between the point from which a worker falls to the point at which deceleration begins because of the action of a personal fall arrest system;
 - The length of the lanyard and anchor point location are important factors that contribute to the length of your free fall.
- Worker's weight, (including tools and clothing)
- Ability of the fall arrest system to absorb the energy of the fall (type of connector).
 - An energy absorber approved to the CSA Standard for energy absorbers will safely absorb energy based on a 2 metre (~6.5 ft.) fall of a 100- kilogram worker.
 - Energy absorbers approved to CEN Standard EN 355: 2002 are currently available in the marketplace that will accommodate a 3.6 metre (~12 ft.) free fall and still limit the maximum arresting force on a 140-kilogram worker to 6 kN (1350).
 - When using these products must take into account the extra clearance that these products require.

Maximum Allowable Free Fall

- Free fall distance in a personal fall arrest system WITHOUT an energy absorber must not exceed 1.2 metres (~4 ft.).
- Free fall distance in a personal fall arrest system WITH an energy absorber is determined by the manufacturer of the energy absorber.

Free fall can be reduced by:

- shortening the lanyard,
- raising the anchor point, or
- locating the anchor point further from the edge.

Limiting the Vertical Distance of a Fall

- Select the shortest length lanyard that will still permit unimpeded performance of the worker's duties, and
- Securing the lanyard to an anchor no lower than the worker's shoulder height.

If the shoulder height anchor is not available, a worker must secure the lanyard to an anchor that is located as high as is reasonably practicable.

Using Low Anchor Points

Regardless of the circumstances a worker must:

- Have sufficient clearance including a safety margin.
- Not exceed allowable free fall distance.
- Not exceed maximum arrest force.

Tying to an Anchor at Foot Level is Dangerous.

- There are situations where using low anchor points can not be avoided, some workers have no alternative other than to anchor at their feet.
- Tying a 1.8 metre (6 ft.) lanyard at foot level can subject the energy absorber to a 3.6metre (~12 ft.) free fall.
- Unless specifically designed for this type of free fall, the energy 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.

Low Anchor Point Problems

- Insufficient Clearance
- Exceed Allowable Free Fall
- Exceed Maximum Arrest Force
- Equipment Failure

Low Anchor Point Solutions

- Horizontal Lifeline
- Self Retracting Device
- Hitching Post
- Specialized Equipment



Swing-Fall / Drop Hazard

- Anchor selection and routing of lifelines over and around structures must take into consideration Swing-Fall / Drop 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.



Swing drop distance Should Not Exceed 4ft.

- 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.



It isn't as simple as it looks.

There are many factors that can influence the distance you travel in a fall and they all must be recognized, evaluated, and kept within required limits, but more importantly within safe limits.

Factors In Calculating Clearance

- Free Fall Distance
- Deceleration Distance
- Total Fall Distance

Free Fall Distance

You must identify your allowable free fall distance as per the manufacturer specifications on your equipment.

Then calculate the free fall and ensure the actual free fall distance does not exceed the allowable free fall as specified by the equipment manufacturer.

You can reduce your free fall and total fall distance by:

- Shortening your lanyard.
- Raising your anchor point.
- Moving the anchor point further from the edge.

Deceleration Distance

Deceleration distance means the additional vertical distance a falling worker travels, after the free fall, before stopping. Deceleration Distance includes:

- D-Ring slippage 0.3 metres (~1 ft.)
- Shock Absorber deployment
- Lanyard Stretch
- Harness Stretch
- SRD Arrest Distance

Total Fall Distance

"total fall distance" means the vertical distance from the point at which a worker falls to the point where the fall stops after all personal fall arrest system components have extended; Free Fall Distance: Must be less than your allowable Free Fall Distance

• Check for the allowable free fall distance which will be the least as established by your equipment manufacturer or the maximum allowed by regulation.

Clearance Requirement (CR): Must be less than the distance between the anchor and the object below.

Safety Margin (SM): Your employer may determine the safety margin but remember some manufacturers identify the safety margin to be used with their equipment.

Check for possible safety margin recommended by the manufacture of your equipment.

Calculating Free Fall Distance (FFD)

FFD = Lanyard Length + D-Ring Height - Distance from anchor to edge.

D-Ring Height is measured from worker's feet to D-Ring (avg is 5 ft.)

Example: Using a 6 ft. lanyard where anchor point is 8 ft. above edge

FFD is 6 ft + 5 ft - 8 ft = 3 ft.

Example: Using a 6 ft. lanyard where anchor point is at worker's feet

FFD is 6ft. + 5ft. - 0ft. = 11ft.

Calculating Clearance Requirement

- Lanyard Length (LL)
- Deceleration Distance (DD) is energy absorber extension, Self Retracting Device "arrest distance," or combination of both
- Height of Worker (H) is how tall the worker is (avg.is 6ft.)
- Safety Margin (SM) is usually 2ft., but equipment manufacturer's or employers may recommend a different safety margin.
- Clearance Requirement (CR)

LL + DD + H + SM = CR

Clearance Calculation



Example: Using an E4 shock absorber LL + DD + H + SM = CR6ft + 4ft + 6ft + 3ft = 19ft

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.)
 - Shock absorber pulling apart: 1.1 m (3.6 ft.) CSA E4 or ANSIcompliant 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

Height of worker—1.8 m (6 ft.)

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. Calculation Exercise #1

- Using a 1.8m / 5ft lanyard with an E4 Shock Absorber.
- Shock Absorber allowable free fall is 1.8m / 6 ft.
- The worker is 6ft tall.
- The anchor point is 8ft from the edge and 20ft above the surface below.

Free Fall Distance

- FFD = Lanyard Length + D-Ring Height Distance from anchor to edge.
- D-Ring Height is measured from worker's feet to D-Ring (avg is 5 ft.)

_____+___-__=____

Clearance Requirement

CR = LL + DD + H + SM = CR

+_____+ _____+ ________= ______

Calculation Exercise #2

- Using a 1.8m / 5ft lanyard with an E4 Shock Absorber.
- Shock Absorber allowable free fall is 1.8m / 6 ft.
- The worker is 6ft tall.
- The anchor point is 8ft from the edge and 20ft above the surface below.

Free Fall Distance

- FFD = Lanyard Length + D-Ring Height Distance from anchor to edge.
- D-Ring Height is measured from worker's feet to D-Ring (avg is 5 ft.)

_____+___-__=____

Clearance Requirement

CR = LL + DD + H + SM = CR

+ _____+ _____+ ______ = ______

This Page Left Blank Intentionally

Water Danger

Notwithstanding Part 24 (Diving,, Fishing, and Other Marine Operations) which covers requirements in those operations, when working near a water hazard where a worker may fall into water that exposes the worker to the hazard of drowning, precautions must be taken.

The following two sections of Part 24 are relative to a water hazard.

24.3 Lifesaving equipment

- (1) Appropriate lifesaving equipment must
 - (a) be provided and maintained for the rescue of any worker in danger of drowning, and
 - (b) be positioned at intervals not exceeding 50 m (165 ft) in conspicuous locations as near as practicable to the danger area.
- (2) Throwing lines fitted to lifebuoys or similar equipment must be of suitable size and length and made of buoyant material.
- (3) For the purposes of this section, lifesaving equipment includes lifebuoys, throwing bags, grapples, boat hooks or other equipment appropriate to the circumstances.

24.6 Rescue boat

A suitable boat must be provided and kept ready for immediate use when workers are employed in situations where a boat is necessary for rescue or evacuation.



Summary

What was covered in Chapter 5?

- Identification of hazards associated with Clearance, Arrest force, Swing-fall, and water hazards.
- Evaluating the risk of hazards associated with Clearance, Arrest force, Swing-fall, and water hazards.
- Reducing the risk of hazards associated with Clearance, Arrest force, Swing-fall, and water hazards.

Chapter 5 Exercise:

- 18. Swing-Fall / Drop can be avoided by.
- (a) Anchoring further away from the edge.
- (b) Selecting an anchor point directly above the work area.
- (c) Doing the work on the ground.
- (d) Using an energy absorber.
- (e) a, b & c
- 19. Swing-Fall / Drop distance should never exceed.
- (a) 30 km/hr
- (b) 3 metres (~10ft.)
- (c) the distance to the ground
- (d) 1.2 metres (~4ft.)

20. True or False?

Calculating free fall distance, total fall distance, and clearance requirements is easy and the formulas should just be memorized so you can do the math in your head.

Chapter 6: Anchors

Goal: The student will have an awareness of the skills necessary to be able to assess an anchor's strength, stability and location.

Objectives:

1. The student will understand the priorities in assessing the location of an anchor point.

2. The student will be able to differentiate the difference between a temporary, or improvised anchor point and an engineered anchor point.

3. The student will be able to relate swing-fall, free fall, arrest force, and clearance requirement to the location and strength of an anchor point.

"anchor" means a component or subsystem of a fall protection system used to connect the other parts of a fall protection system to an anchorage, and includes an anchorage connector;

"anchorage" means a secure connection point for a fall protection system;

Example 1



Example 2



Anchors

The Regulation defines an anchor as "a secure point of attachment for a lifeline or lanyard." Types of anchors under this definition include:

- A device that has been purposefully manufactured and installed as an anchor to support a personal fall protection system. These anchors must meet all required standards.
- A substantial structure, such as a beam, column or similar substantial portion of the structure, selected as a point of anchorage where no dedicated anchor device is available. These *points of anchorage* generally require some supplemental rigging, such as a sling, to allow the anchorage connector of a personal fall protection system to connect to the anchorage.

Pre-use Inspection of Anchors

- 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.

Anchor Connector

- 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.

Duty to Use Anchors

- There have been many instances of workers being equipped with the appropriate fall protection equipment but failing, for whatever reason, to clip into an anchor.
- To be effective, personal fall arrest and Fall Restraint systems must be safely secured to an anchor, i.e., lanyard or self-retracting device must be clipped in.
- If a worker uses a personal fall arrest or a Fall Restraint system, the worker must ensure that it is safely secured to an anchor that meets the requirements of Part 11.

Independence of Anchors

Each personal fall protection system that is connected to an anchor must be secured to an independent attachment point.

If a person is supported on a work platform suspended by fewer than four suspension lines, the person must use a personal fall arrest system secured to an anchor meeting the requirements of Part 11 (Fall Protection) and independent of the work platform and its suspension



Location and Strength of Anchors

- 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.

Factors to Consider:

- Swing-fall / drop
- Free Fall
- Arrest Force
- Clearance Requirement.
- Stability

If an anchor is located on a mobile or erected structure such as a bucket truck, man-lift 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.

Strength of an Anchor Depends On

- The design of the anchor
- The orientation of the anchor relative to the direction of loading
- The condition of the anchor
- The connection of the anchor to the supporting structure
- The adequacy of the structure to resist the imposed loading

Natural Anchors

• Natural anchors, such as large well-rooted trees or rock outcroppings can be acceptable points of anchorage as well if deemed by a qualified person to be able to withstand the forces that may be imposed by the fall protection system.

Improvised 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 Fall Restraint and fall arrest systems.

Improvised anchors are not manufactured to any technical standard.

Improvised anchors may include a beam, struts of a communication tower, a concrete column, a sizeable tree, a locked out and chocked vehicle, or other similar, robust structures.



Assessing the Strength of Improvised Anchors

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 2,268 kilograms (5000 pounds) can be held, then the anchor is a good one.

The anchor must be "bomber" or "bombproof."



Load Capacity

Temporary Fall Restraint Anchor

- In a temporary fall restraint system, an anchor for a personal fall protection system must have an ultimate load capacity in any direction in which a load may be applied of at least:
 - 3.5 kN (800 lbs), or
 - four times the weight of the worker to be connected to the system.

Temporary Personal Fall Arrest Anchor

- In a Temporary Personal Fall Arrest System an anchor for a personal fall protection system must have an ultimate load capacity in any direction required to resist a fall of at least:
 - 22 kN (5 000 lbs), or
 - twice the maximum arrest force.
 - If an employer proposes to use an anchor for a temporary fall arrest system with an ultimate load capacity of less than 22 kN (5,000 lbs), the employer will need to be able to demonstrate that the anchor has an ultimate load capacity of twice the maximum arrest force (MAF) at the particular location.

Permanent Personal Fall Arrest Anchor

• A Permanent Personal Fall Arrest System anchor must have an ultimate load capacity in any direction required to resist a fall of at least 22 kN (5 000 lbs).

Anchor Strength Summary

Fall Arrest Anchor Strength (temporary or permanent)	Fall Restraint Anchor Strength		
	Temporary	Permanent	
22 kN / 5,000 lb Or 2 x Maximum Arresting Force (MAF)	3.5 kN / 800 lb Or 4 times the weight of the worker	22 kN / 5,000 Or 2 x MAF Since there is no category for "permanent Fall Restraint anchor," these anchors default to being fall arrest anchors.	

Twice the Maximum Arresting Force

- The twice 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 22 kN (5,000 lb) minimum breaking strength for anchors.
- In some cases, and especially on complex fall protection systems, a professional engineer will design the system and calculate the expected MAF.
- Having all anchors comply with the minimum anchor point strength of 22 kN (5,000 lb) 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."

Temporary Anchor Point Removal & Markings

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.

- Temporary anchor points should be removed upon completion of the work for which it was intended.
- Permanent Mark A temporary Fall Restraint anchor point should be permanently marked as being for Fall Restraint only.

Some examples of available anchors





Reusable Bolt Anchor - for use where a temporary anchorage is required. Designed to be installed in concrete, it can be easily removed and reused.



BCTSWH100Y

Hybrid Swivel Anchor - for use where a temporary or permanent anchorage is required. Designed to be installed permanently in concrete, but it can be easily moved to another location. Its unique design allows it to rotate a full 360 degrees to follow the worker while maintaining 100% tie off.



BCTBWA014B

Sliding Flangebar with Quick Ratchet Locking System - for use where a temporary or permanent anchorage is required. Designed to attach to the top or bottom of horizontal beams, it fits beams 3.5" to 14" wide and 1.125" in thickness. Its unique design allows it to slide smothly along the flange of the beam to follow the worker while maintaining 100% tie off. Some examples of available anchors (continued)



MRRA1

- Single use only remove, bend or sheath over after using
- One person capacity
- Exceeds 5000lbs minimum breaking strength

Stainless steel permanent roof anchor -One person capacity on each side -Exceeds 5000lbs minimum breaking strength -





N5072F

- Reusable roof anchor
- One person capacity
- Exceeds 5000lbs minimum breaking strength

Truss Anchor



Wire Rope Sling as an 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.
- As slings are generally used as temporary fall arrest anchors, these slings must be rated to a minimum breaking strength of at least 22 kN (5,000 lb) or two times the maximum arresting force per worker attached.
- Wire rope slings used as anchorage connectors must be terminated at both ends with eye splices rated to at least 90 percent of the wire rope's minimum breaking strength.
- Never place a snap-hook through the eye-lets, always use a carabiner or ring as shown below.



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.
- Because of their complex performance characteristics, flexible horizontal lifeline systems must meet the requirements of all applicable standards.
- 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.

Example of wire rope used as horizontal lifeline



Horizontal Lifeline Systems

Before a horizontal lifeline system is used, a professional engineer, a competent person authorized by the professional engineer, the manufacturer, or a competent person authorized by the manufacturer must certify that the system has been properly installed according to the manufacturer's specifications or to specifications certified by a professional engineer. (or in a manner acceptable to the Board)



Capacity 620lbs (Two Workers)

Horizontal lifeline systems can be very complex due to the many variables from one system to the next which explains the strict requirement for oversight by professional engineers to ensure all required standards are met.

There are a few critical points that workers using horizontal lifelines need to keep in mind.

- Never exceed the number of authorized users.
- Always check for the manufacturers' or engineers' labels.
- Always check recertification date.
- Always confirm available clearance

Example of rigid rail



Certification of Anchors by Engineer

- The following types of equipment and systems, and their installation, must be certified by a professional engineer:
 - permanent anchors,
 - anchors with multiple attachment points,
 - permanent horizontal lifeline systems, and
 - support structures for safety nets.

The drawings and instructions required should show:

- The layout in plan and elevation, including anchor locations, installation specifications, anchor design, and detailing.
- Horizontal lifeline system specifications, including permissible free fall distance, clearance to obstructions below, and rope size, breaking strength, termination details, initial sag or tension.
- The number of workers permitted to connect to the lifeline, and maximum arrest force to each worker.

Inspection and Removal of Anchors from Service

- An anchor must not be used until it has been inspected and recertified, by a
 professional engineer, as meeting the requirements of an applicable CSA or ANSI
 standard.
- The entire standard should be consulted for complete requirements.
- The standards specify that the manufacturer's instructions are to be followed, or, in the case of an engineered system, the engineer's instructions for the removal from service of fall protection anchors.

The following information is being provided for awareness only.

Cornice hook and parapet clamp use:

Due to the need to accurately assess the strength of the locations for attachment, this equipment should only be used by people who are competent in their use.

A cornice hook is a device that functions as a portable or temporary anchor for a suspension line.

A parapet clamp is a device that functions as a portable or temporary anchor for a suspension line, lifeline, or tieback line.

A cornice hook or parapet clamp can only function effectively as an anchor if it is positioned on a part of the building or structure that is structurally able to support the loads the clamp or hook will apply. This Page Left Blank Intentionally Chapter 6 Exercise:

21. True or False?

Workers should tug or reef on a potential anchor as a test to see if it will hold.

22. The minimum anchor point strength for a temporary or permanent fall arrest, or permanent Fall Restraint is.

(a) 22.5 kN / 5,000 lbs

(b) 16 kN / 3,600 lbs

(c) 3.5 kN / 800 lbs

(d) none of the above

23. The "two times maximum arresting force" approach should only be used.

(a) in accordance with the manufacturer's specifications

(b) a & c

(c) under the supervision of a professional engineer who can accurately determine the peak forces and the available anchorage strength.

(d) by a worker who is good at math and can estimate speed and velocity accurately.

Summary

What was covered in Chapter 6?

- Priorities in assessing the location of an anchor point.
- Difference between a temporary, or improvised anchor point and an engineered anchor point.
- How the location and strength of an anchor affects swing-fall, free fall, arrest force, and clearance requirement.

Chapter 7: Special Situations

Goal: The student will have an awareness of various fall protection systems used for unique work areas and tasks.

Objectives:

1. The student will understand that specialized equipment and procedures will require training specific to the equipment being used and the training must be done by a competent person.

- 2. The student will have an awareness of the following:
- Sections related to fall protection from Part 4 General Conditions
- Sections related to fall protection from Part 13: Ladders, Scaffolds and Temporary Work Platforms
- Sections related to fall protection from Part 20. Construction, Excavation and Demolition
- Fall protection in Masonry Construction
- Fall Protection in Agriculture
- Fall Protection in Fixed Seating Areas
- Fall Protection During Stunt Work
- 3. The student will know how to access additional information not covered in this course.

Introduction

- It is important to understand that information directly related to fall protection from Part 4, Part 13, and Part 20 will be discussed in this chapter, and the information being presented in this chapter is for awareness only.
- There may be other sections that affect individual employers and employees that is not covered in this chapter.
- It is the employers' and employees' responsibility to ensure they are compliant with all Parts of the OH&S Regulation that apply to their workplace.

Work Area Guards and Handrails

Elevated Workers

If the task you are performing results in your fall protection system to not provide sufficient protection you must re-evaluate and ensure adequate protection is provided in accordance with Part 11.

Floor and Roof Openings

 All pits and openings must be secured and adequate protection to all workers maintained

Ladders, Scaffolds and Temporary Work Platforms

OHS Regulation Part 13:

Standards

- A ladder, window cleaner's belt or work platform must meet and be used in accordance with the applicable CSA or ANSI standard in effect when the equipment or structure was manufactured, except as otherwise determined by the Board.
- If there is no applicable standard under paragraphs (a) or (b), the requirements of a professional engineer.

Inspections

- A ladder, window cleaner's belt, work platform and associated components must be inspected before use on each shift, and after any modification, and any condition that might endanger workers must be remedied before the equipment is used.
- A manufactured portable ladder must be marked for the grade of material used to construct the ladder and the use for which the ladder is constructed.

Position and Stability

- A portable ladder must:
 - be placed on a firm and level surface, and
 - be of sufficient length to enable the safe performance of the work activity while being used.
- A portable non-self-supporting ladder must as shown in below, be positioned so that the ladder is leaning against the vertical plane of support at an approximate angle of 75° when measured from the horizontal plane of support,
- If the ladder provides access to or egress from an upper landing,
 - project approximately 1 m (3 ft) above the upper landing, and
 - be sufficiently secured in place to ensure the stability of the ladder during access to or egress from the upper landing, and



Use restrictions

- If work cannot be done from a ladder without hazard to a worker, a work platform must be provided.
- A worker must not carry up or down a ladder, heavy or bulky objects or any other objects which may make ascent or descent unsafe.

High Risk Situations

- Before a swing stage, boatswain's chair or portable powered platform is used in any of the following circumstances,
 - one work platform will be used above or below any portion of another work platform,
 - a deck or planking will be used to span a gap between two independent work platforms,
 - the work platform will exceed 10 m (32 ft) in length, or
 - the suspension height will exceed 91 m (300 ft).
- A professional engineer must have certified in writing that the design, installation and proposed use of the swing stage, boatswain's chair or portable powered platform, as the case may be, meets the requirements of all applicable standards.

Fall protection on Elevating Work Platforms

- A person on an elevating work platform must wear a personal fall arrest system secured to a suitable and substantial anchorage point.
- The lanyard should be short enough to prevent the worker from being ejected or from falling out of the work platform or lift.

Stop Using 6ft lanyards in lifts!

• A person on a scissor lift, or on an elevating work platform with similar characteristics to a scissor lift, that is on a firm level surface with no irregularities to cause platform instability, is exempt from wearing a personal fall arrest system, provided that all manufacturer's guardrails and chains are in place.

Guardrails or railings are not anchor points!

May an employer supersede regulations, and implement policies and procedures, that increase the safety for workers?

- Each person on a work platform suspended from a crane or hoist must use a personal fall arrest system with a energy absorbing lanyard, secured to:
 - an anchor above the load hook, or
 - an anchor attached to the platform and designated for that purpose by the manufacturer or a professional engineer, provided that the platform has a safety strap that will prevent the platform from falling more than 15 cm (6 in) if the platform becomes dislodged from the hook.
- Each person on a work platform attached to a crane boom must use a personal fall arrest system secured to an anchor on the boom or on the platform that is designated by the manufacturer, or a professional engineer.

Part 20 Construction, Excavation and Demolition

Walkways

• A worker must not walk upon the surfaces of structural members that have shear connectors, dowels or other protrusions unless suitable walkways and runways are provided to eliminate the tripping hazard.

Crawl boards and ladders

- Crawl boards or ladders used for roof work must be securely fastened over the ridge of the roof or must be otherwise effectively anchored.
- The use of an eavestrough to support a crawl board or ladder on a roof is prohibited.

Steep Roof Requirements

 If a worker is employed on a roof having a slope ratio of 8 vertical to 12 horizontal or greater, the worker must use a personal fall protection system or personnel safety nets must be used, and 38 mm x 140 mm (2 in x 6 in nominal) toe-holds must be used if the roofing material allows for it.

Note: Exposed horizontal roof strapping may be used as toe-holds as long as it provides safe footing.

Chutes and hoists

• The roof edge about a chute, bitumen spout and material hoist must have guardrails meeting the requirements of Part 4 (General Conditions) or barriers of at least equivalent strength to at least 2 m (6.5 ft) on each side of such a work area.

Mechanical equipment

• Mechanical or powered equipment which has the potential to push or pull a worker over an unguarded edge must not be used unless operated according to procedures acceptable to the Board.

Guarding

• If an excavation is a hazard to workers, it must be effectively covered or guarded.

Excavation crossings

• A walkway across an excavation must be at least 50 cm (20 in) wide, and if crossing an excavation over 1.2 m (4 ft) deep, be equipped with guardrails, meeting the requirements of Part 4 (General Conditions), on both sides.

Rappelling and Work Positioning Systems

- A worker on a rock face or other steep slope must be protected from falling by a work positioning or rappelling system, or by a fall arrest system as required by Part 11 (Fall Protection).
- A single rope work positioning system may be used by a worker to rappel to and remain in work locations on a rock face or other steep slope if tension is maintained in the rappel rope at all times so that the worker is not exposed to a free fall.
- If the work practice could result in a slack line in the rappel or work positioning system and a fall could occur, a personal fall arrest system, independently anchored, meeting the requirements of Part 11 (Fall Protection) must be used.
- Rappelling techniques must provide for automatic stopping by means of a mechanical fall arrestor, Prusik sling or other device acceptable to the Board.
- A rappelling or fall protection system must be used in a manner that minimizes the swing-fall hazard.

A rappelling rope must:

- be synthetic fibre rope with a breaking strength specified by the manufacturer of at least 27 kN (6,000 lbs) or be at least 16 mm (5/8 in) diameter wire-cored fibre rope,
- be long enough to reach a safe landing spot from which egress without rappelling is possible, and
- not be lengthened by tying ropes together.

Anchors and Other Hardware

- The ultimate load capacity of an anchor for a rappelling or fall protection line must be at least 22 kN (5,000 lbs).
- Each rappel line and fall arrest lifeline that is tied to a natural anchor such a suitable tree, stump or rock outcrop must also be tied to a second anchor of at least equal load capacity.
- A rappelling rope must be attached to an anchor and, where practicable, must be positioned to avoid bearing on any sharp edge or surface likely to cause rope damage, and if it is not practicable to avoid sharp edges or surfaces, rope protectors or wire-cored rope must be used.

Harnesses

• A sit harness with rope attachment below waist level may be used for work positioning or rappelling.

Fall Protection in Masonry Construction

Structural masonry is the use of 200 mm (8 inches) or wider concrete block or structural clay brick laid and reinforced as stand-alone walls. Typical applications are for warehouses, schools, or commercial buildings, with wall heights generally of 3 to 7 metres (10 to 23 feet), occasionally reaching 9 metres (30 feet).

- Generally, masonry work more than 1.5 metres (5 feet) above ground or floor level is done from a scaffold work platform. For platform heights of less than 3 metres (10 feet), guardrails or another fall protection system is not required.
- The use of guardrails or other fall protection is practicable for most masonry construction but is impracticable in some situations during the placement of structural concrete block during wall construction.
- Work off platforms 3 metres or more high requires fall protection. This is generally provided on the backside and ends of the work platform through use of guardrails.
- If the masonry or block is being laid against an existing building wall, there is no forward fall hazard, so no guardrails need to be on the front or working side of the work platform.
- However, if the structural wall is a stand-alone wall, there is no "front wall" or barrier immediately behind the new wall.
- As the wall construction progresses beyond 3 metres in such cases, section 11.2 requires fall protection measures be taken.
- It is not practicable to have guardrails and support posts in the same workspace where the structural masonry units are being laid.
- For the first 3 courses of block (approximately 60 centimetres or 24 inches) above the level of the work platform, a personal fall restraint system is to be used by workers laying block and working on the forward edge of the work platform.

Fall Protection in Masonry Construction (continued)

- After the completion of at least 3 courses of block being laid, the worker(s) laying block may remove the personal fall protection and continue laying block with the newly laid block wall being considered as effective fall protection for masons working at the front or working face of the work platform.
- Note that the work platform is always positioned at least 3 courses (60 centimetres) below the top of the last full course of structural masonry laid, so personal fall protection is not needed. However, if the work platforms are repositioned so that the distance from the platform surface up to the top of the last full course of masonry laid is less than 60 centimetres, personal fall protection needs to be used.
- If the above procedure is to be used, a written fall protection plan for the work is required by section 11.3(1)(b) of the Regulation.

Fall Protection in Agriculture

- There are several circumstances in agriculture, for example in greenhouse, dairy, and some other animal husbandry operations, which may present some unique challenges for fall protection.
- Fall protection hierarchy; In greenhouse operations, equipment designed to provide fall protection for use on roofs during work activities such as repairing, glazing, and cleaning greenhouse glass may provide a practicable means of hazard control. The use of such equipment is increasingly common in this sector.
- In the dairy and some other animal husbandry sectors, haylofts may be an area of concern. In some cases, it may be feasible to use guardrails, particularly along edges that are not in use. Another option that may be appropriate is a system of retractable netting to provide fall restraint next to the work area, which is drawn into place when workers are on the loft. If such systems are not practicable in a workplace, personal fall restraint or fall arrest systems may be feasible.
- In circumstances where systems of fall restraint or fall arrest, or rope access are not practicable, or a system of fall arrest or rope access will result in a hazard greater than if the system is not used, a further option provided by the fall protection requirements is the use of other acceptable work procedures that will minimize the potential for a worker to fall i.e., use of control zones, safety monitors and other procedures.

Fall Protection in Fixed Seating Areas

- Many fixed-seating buildings such as theatres, stadiums, and arenas contain balconies or mezzanines that are greater than 3m above a lower area.
- In many of these buildings, guards exist that do not meet the requirements for guards or guardrails as outlined in Part 4 of the Regulation.
- Under the applicable provincial and municipal building codes, lower guards at lower heights (e.g., 30 inches, as opposed to the 40-44 inch standard guardrail requirement under section 4.58(1)) are allowed due to the unique purpose of the building.

No such exemptions or allowances exist in the Regulation Section 11.2 must be followed to protect workers.

Safe Work Procedures

- The Regulation sets out requirements for fall protection under section 11.2 in a set of cascading requirements.
- Work procedures to minimize risk of injury due to a fall in fixed-seating areas such as stadiums, arenas, or theatres may present challenges.

The Bottom Line

Not withstanding the unique characteristics of many fixed seating facilities fall protection provisions are to be applied to protect workers who engage in work at heights around fixed- seating in buildings such as stadiums, arenas, and theatres.

Fall Protection During Stunt Work

• Typically, the qualified person is a stunt coordinator or special effects rigger, a live performance technical director or rigging technician, or a professional engineer. The qualified person must be knowledgeable of the work, the hazards involved, and the means to control the hazards, by reason of education, training, experience or a combination of these.

Application of the Hierarchy of Controls

- Section 11.2(2)-(5) of the Regulation provides a hierarchy of four types of fall protection, based on practicability. Section 1.1 of the Regulation defines "practicable" as "that which is reasonably capable of being done."
- When applied to stunt work, there will be occasions where the use of guardrails or other means of fall restraint are practicable to use, for example in work positioning or where a stunt person is moved through space by means of a system designed to prevent falls. However, for many circumstances where a stunt involves a deliberate and planned fall these measures will not be practicable, and either a fall arrest system is required, or work procedures acceptable to WorkSafeBC.
- For example, a fall arrest system would be appropriate for a stunt involving a fall over a limited distance where the fall can be designed so that arrest is the appropriate means of ensuring worker safety. Such systems would need to meet other requirements in Part 11 of the Regulation, for example, section 11.5 on Equipment standards.
- In some circumstances the production may require that a fall be un-arrested to obtain the needed visual effect. In these cases, the fall must be designed and carried out to minimize the risk of injury to the stunt person, using procedures acceptable to WorkSafeBC, as required by section 11.2(5).
- Note that section 11.3 of the Regulation requires that wherever work is being done at a location where workers are not protected by permanent guardrails and from which a fall of 7.5 m (25 feet) or more may occur, or where work procedures are used as the means of fall protection under section 11.2(5), then a written fall protection plan must be in place before work begins.
- Procedures that minimize the risk in a planned, un-arrested fall section 11.2(5)
 In some circumstances, for reasons of practicability, a stunt will be planned for a fall without fall arrest. This circumstance typically arises where, for production reasons and visual effect, it is impracticable to use a system of fall arrest, or to use other measures that simulate the fall such as dummies or camera angles.

Fall Protection During Stunt Work (continued)

For such circumstances section 11.2(5) of the Regulation requires that procedures be followed that are acceptable to WorkSafeBC and which minimize the risk of injury to the stunt person.

It has been determined that acceptable procedures are those that meet at least all of the following criteria:

- The risks to workers in the stunt are thoroughly assessed and controls adopted that minimize the risk.
- Measures are implemented, where practicable, to minimize the height of the fall and control the rate of deceleration.
- The fall is designed to ensure that a stunt person does not make unintended contact with a surface during a fall.
- The area of intended contact is designed so that the dimensions are sufficient to ensure that the stunt person lands on it.
- Cushioning is provided to minimize any risk of injury, for example, by use of padding, collapsible boxing, air bags, safety nets or other means approved by a qualified person.
- There are no protrusions or other circumstances in the area of intended contact that create a heightened risk of injury.
- Provision is made to address any circumstance where the stunt person may, after initial contact with the intended surface, be deflected into an adjacent area.
- Trial tests or rehearsals are done prior to the stunt using a test torso or equivalent device, and any corrections to the stunt made as necessary. Note: such tests or rehearsals are both appropriate and needed in typical stunt circumstances. Any determination otherwise in a particular case will be made only by a qualified person.
- Stunt persons and other personnel involved with the stunt are properly trained in the use of all applicable procedures and equipment involved in the stunt.
- Supervision is provided to ensure activities are coordinated and safety standards are met.

Standards for Equipment in a Fall Protection System Used in Stunt Work

- Section 11.5 (Equipment standards) of the Regulation requires that equipment used in a fall protection system consist of compatible and suitable components and be sufficient to support the fall restraint or arrest forces. In addition, section 11.5(c) requires that the equipment, "...meet and be used in accordance with, an applicable CSA or ANSI standard in effect when the equipment was manufactured, subject to any modification or upgrade considered necessary by the Board."
- There are circumstances in stunt work where a safety harness meeting CSA or ANSI standards is impracticable or otherwise inappropriate. For example, in the actual conduct of a stunt such a harness may be too bulky or involve points of attachment that interfere with the intended fall. Under section 4.4(2)(a) of the Regulation a person may, if a standard is referenced in the Regulation, comply with an alternative standard where acceptable to WorkSafeBC.
- For the purposes of stunt work, WorkSafeBC accepts the alternative standard set out in italics below in circumstances where the use of equipment meeting CSA or ANSI standards is impracticable. The alternative standard provides several options for determining acceptable equipment.

Alternative Standard for Fall Protection Equipment Used in Stunt Work

- This standard applies to the selection and use of fall protection equipment in stunt work, for falls and suspended movements that are planned and conducted in a controlled manner. During a controlled fall, the maximum arrest force must not exceed four times the worker's weight.
- Prior to selection of equipment used in a system for fall restraint or fall arrest, a risk analysis must be done to determine the hazard to workers. Equipment must be selected based on that analysis.

Fall Protection Equipment Used In Stunt Work

The equipment in the fall protection system used in stunt work must meet at least one of the following applicable criteria:

- All equipment used in the system is certified as suitable for use in the manner intended in the stunt by the equipment manufacturer, the manufacturer's authorized representative, or by a professional engineer. (See OHS guideline G1.1 "Professional engineer" for further information on engineering practice.)
- The system is designed to withstand a restraint force or an arrest force of at least four times the worker's weight (4 G's), and so that the harness and associated components will not fail when a static force representing the lesser of either twice the restraint or peak arrest force, as applicable, or 5,000 pounds (22.2 kN) is applied.

Trial Drop Test

- For fall arrest systems used in stunt work, prior to the stunt, a trial drop test (using a test torso or equivalent) is successfully performed that replicates the stunt, including the free fall distance and the worker's weight.
- A load cell will be used during the test to monitor the peak arrest force, and the recorded values shall not exceed four times the person's weight.

Stunt Design

- The stunt must be designed so that all factors that could potentially cause the performance of the fall protection system to fail are considered and hazard, exposure of the system to chemicals, alteration of equipment, lifeline abrasion, entanglements and the attachment location of the lanyard to the harness.
- Documentation must be available at the work location where the stunt is to be performed which establishes that the equipment meets the applicable criteria.

This Page Left Blank Intentionally Re-using Equipment Used in Stunt Work After it has Arrested a Fall

- If a personal fall protection system has been used to arrest a fall, section 11.10(1) of the Regulation requires that the system be removed from service, and not be returned to service until it has been inspected and recertified as safe for use by the manufacturer or its authorized agent, or by a professional engineer. Typically, the circumstances which this requirement is intended to address are accidental falls and may involve minimal energy absorption during the arrest of the fall.
- In contrast, in the stunt performance sector, falls are planned and often involve the use of deceleration systems that substantially reduce arrest forces in the fall, thus reducing stresses on workers and equipment. Practicability issues are also of concern in this sector given that during normal use, a safety harness system will often be used repeatedly during a given stunt procedure.
- On this basis, section 11.10(2) & (3) provides an exemption to the recertification for personal fall protection systems designed and intended for reuse by a performer in the entertainment industry when conducting a planned fall sequence. The exemption applies only if all of the following conditions are met
 - the system is designed and used in accordance with a standard acceptable to WorkSafeBC
 - each use of the system is carried out in accordance with the plan for the conduct of the fall
 - the peak arrest forces generated in the system during each use do not exceed the planned limits and the maximum forces allowed for the system, and
 - after each use of the system, no part of it, including the anchorage, is reused until a qualified person has inspected it and determined it is in serviceable condition and safe for reuse

Inspecting Equipment Used in Stunt Work

Note that section 11.9 of the Regulation also addresses inspection requirements. This provision requires that equipment used in a fall protection system be inspected by a qualified person before use on the work shift, kept free from substances and conditions that could contribute to its deterioration, and maintained in good working order.

- It is important to inspect personal fall protection equipment on an ongoing basis to ensure safety.
- At minimum this involves inspection before use on each work shift, and after each use to arrest a fall. It is also recommended to inspect equipment just before each use if not already covered by one of the other inspection scenarios.
- Such inspections are only one aspect of the overall review and monitoring of conditions and procedures for the performance of stunts.
- When evaluating the condition of equipment used for stunt work it is important to understand the circumstances of previous use, including conditions and frequency of use, and any substantial loads to which the harness was subjected.
- This information should be tracked in order to help ensure worker safety and to provide a means of helping to demonstrate compliance with sections 11.9 and 11.10(3)(d).
- A log book or other similar record can be an effective means of recording inspection information, and may have particular application to harnesses that are used on an ongoing basis.
- The log book provides a record which, among other things, can assist with a determination of the appropriate point of removal from service.
- Log book information needs to be specific to the equipment involved.

The Bottom Line

Inspections must be done As per Part 11, Section 11.9 Inspection and maintenance

Removing Equipment Used in Stunt Work From Service

- Harnesses should be removed from service in circumstances such as the following:
 - Any part of the harness, including stitching, has been cut, stretched, frayed or otherwise damaged
 - The harness has been exposed to temperatures above 200 degrees F (93 degrees C), or other temperature specified by the manufacturer. Note: The specified temperature is just below the boiling point of water.
 - The harness has been exposed to chemicals (e.g. solvents, acids, alkalis) that may affect the integrity of the harness
 - Any part of the harness has received a shock-load in excess of 1000 pounds (4.5 kilonewtons), or other maximum shock load specified by the manufacturer.

Note: a fall arrest system designed to meet the 4 G peak arrest criterion in the alternative standard in this guideline is not likely to experience a shock load exceeding 1000 pounds, except if a worker's weight exceeds 250 pounds (113 kg).

Further, if the system includes a personal energy absorber (PEA), a person should not experience a peak arrest force exceeding the criterion unless the PEA fully deploys so that the lanyard extends fully and there is in an abrupt stop. Most PEAs deploy at an average force of 630 - 810 pounds (2.8 to 3.6 kN).

Other equipment is treated the same as any equipment used in fall protection

Accessing Additional Information

Chapter 6 has been a brief overview of a few of the regulations related fall protection in special situations.

Additional information and details can be found through the

WorkSafeBC web site.

https://www.worksafebc.com/en/law-policy/occupational-healthsafety/searchable-ohs-regulation Chapter 7 Exercise:

24. True or False?

If a worker must enter an area not normally accessible and that has openings that are a danger, the worker needs to be careful, but no other precautions are required.

25. To ensure stability of a portable ladder, the ladder must:

(a) be placed on a firm and level surface.

(b) be of sufficient length to enable the safe performance of the work activity while being used.

(c) be positioned so that the ladder is leaning against the vertical plane of support at an approximate angle of 75° when measured from the horizontal plane of support,

(d) All of the above

26. If the ladder provides access to or egress from an upper landing, the ladder must:

(a) project approximately 1 m (3 ft) above the upper landing.

(b) be sufficiently secured in place to ensure the stability of the ladder during access to or egress from the upper landing.

(c) both (a) & (b) are required

(d) none of the above

27. True or False?

If work cannot be done from a ladder without hazard to a worker, a work platform must be provided.

28. True or False?

A worker must not carry up or down a ladder, heavy or bulky objects or any other objects which may make ascent or descent unsafe.

29. True or False?

All fall protection regulations for stunt work are exactly the same as construction work.

30. True or False?

While working in fixed seating areas construction workers are exempt from fall protection regulations.

Summary

What was covered in Chapter 7?

Specialized equipment and procedures require training specific to the equipment being used and that the training must be delivered by a competent person.

Brief Overview of the following:

- Sections related to fall protection from Part 4 General Conditions
- Sections related to fall protection from Part 13: Ladders, Scaffolds and Temporary Work Platforms
- Sections related to fall protection from Part 20. Construction, Excavation and Demolition
- Fall protection in Masonry Construction
- Fall Protection in Agriculture
- Fall Protection in Fixed Seating Areas
- Fall Protection During Stunt Work
- How to access additional information not covered in this chapter.

Chapter 8: Potential Injuries Due to Falls

Goal: The student will understand the effect of a fall on the human body, and how to reduce the risk of injuries due to a fall.

Objectives:

1. The student will have a basic understanding of mechanism of injury in falls.

2. The student will have a basic understanding of suspension trauma, and how to reduce the effects.

3. The student will understand the importance of selecting the correct harness, don a harness correctly, and understand how a properly fitted and adjusted harness can reduce the risk of injury.

4. The student will understand the safety procedures to be followed before and during the harness suspension.

Effect of Falling on The Human Body

- Injuries due to a fall will vary depending on the distance a person falls, body weight, orientation of the body upon impact, and the nature of the surface impacted.
- The distance of the fall is the major determining factor.
- As a person falls the kinetic energy increases due to acceleration during the fall and is at maximum at the moment of impact.
- The kinetic energy is transferred into the body causing the injuries.
- A fall will almost always result in injury, from very minor scrapes, cuts, bruises and abrasions to moderate injuries such as fractures of long bones.
- More severe injuries including injuries up to and including death are possible.
 - Arrest forces may result in heavy organs such as the heart, liver, kidneys, and spleen to tear away from blood vessels.
 - Concussion and brain injuries are also possible.
 - Blunt force trauma may result in internal and external hemorrhage as well as fractures to the skull, and other bones.
 - Landing on objects may cause penetrating injuries.



Injury Prevention and Control

- The OH&S Code requires hazards to be eliminated when possible.
- Control trip and slipping hazards: Even a fall from standing height can result in a serious injury, a lot has to do with what you land on. There isn't a lot of friendly ground on most construction sites.
- Choose the least risky fall protection system: Even though elimination of hazards is your first obligation, some work will always be required to be done at height.
- Inspect your equipment before each use.
- Use equipment designed for the task.
- Keep your free fall as short as possible. The further you free fall, the faster you go, and the more serious the injuries can be.
- A Full Body Harness is the only acceptable means of stopping a falling workers body. Wear the right harness, adjust it properly, and use the correct D-Ring for the task.
- Use a Self-Retracting Device whenever possible.
- Use an energy absorber in all other circumstances.
- Always confirm you that you have sufficient clearance.
- Keep your eye on what is going on beneath where you are working in case your clearance changes
- Always work directly below your anchor. Swing fall can cause injuries when you crash into a structure or piece of equipment. Your energy absorber won't help in a swing fall.

Suspension Trauma

• AKA – harness hang syndrome (HHS), suspension syndrome, orthostatic intolerance, harness induced pathology, or orthostatic shock while suspended.

What Is Suspension Trauma?

- Suspension trauma is an effect which occurs when the human body is held upright without any movement for a period of time.
- If the person is strapped into a harness or tied to an upright object they will eventually faint.
- Fainting while remaining vertical increases the risk of death from lack of oxygen to the brain.

(Since there is no evidence that these effects are specifically due to trauma, or caused by the harness itself, climbing medicine authorities have argued against the terminology of suspension trauma or harness hang syndrome and instead termed this simply "suspension syndrome").

What Causes Suspension Trauma?

- The most common cause is accidents in which the person remains motionless suspended in a harness for longer periods of time.
- Motionlessness may have several causes including fatigue, hypoglycemia, hypothermia or traumatic brain injury.

Symptoms of Suspension Trauma

- Onset of symptoms may be after just a few minutes, but usually occurs after at least 20 minutes of free hanging.
- Typical symptoms are paleness, sweating, shortness of breath, blurred vision, dizziness, nausea, hypotension and numbness of the legs.
- Eventually it leads to fainting, which may result in death due to oxygen deprivation of the brain.

Reducing the Effects of Suspension Trauma

- Breath, full deep respirations
- If someone is stranded in a harness, but is not unconscious or injured, and has something to push against or stand on it is helpful for them to use their leg muscles by pushing against it every so often, to keep the blood pumping back to the torso.
- If the person is stranded in mid-air then keeping the legs moving can be beneficial.
- Use of suspension straps or simply a loop in a rope in which the person hanging can take some weight off the leg straps to help the blood to flow.

What Can You Do While Waiting to Be Rescued?

- Breath
- Use Suspension Relief Straps (be sure to cross the straps)





- Move Your Legs
- Bring Your Knees Toward Your Chest
- Get Your Foot Up on A Structure Near By

Full Body Harness

Full Body Harness



Full Body Harness Selection

Standards

• Verify your equipment meets all required standards.

Materials

• Know your hazards and environment. Select equipment that is compatible with the environment and hazards you may be exposing them to.

Sizing

- Like people, harnesses can be different. They look different and they feel different.
- Some manufacturers use universal sizing (one size fits all). Others use weight range and height which will probably result in the safest and most comfortable fit.
- You need to find a harness that is comfortable for you to wear when it is adjusted for safety.

Before You Purchase

• Find out where the harness is made and verify that the harness meets all required standards (CSA CAN/CSA-Z259.10 Full Body Harnesses).

What to Avoid

- Avoid harnesses with only use loop & hook (Velcro) to secure the straps.
- Avoid harnesses without back straps.

Buy the Right Harness For the Job

- Buy the right harness for the job. Harnesses come with a wide range of D-Ring locations, each used for different applications.
- The only acceptable style of harness for fall protection is a full body harness.

The following information regarding classifications for full body harnesses is copyrighted by Safety Direct Inc.

Classifications For Full Body Harnesses

The Canadian Standards Association (CSA) establishes the classifications for full body harnesses. A harness can have more than one classification, however, all full body harnesses must meet the requirements for class A Fall Arrest.



Class A Fall Arrest

Class A harnesses are designed to protect workers when they are six feet or more above the ground. They support the body during and after a fall. Dorsal (back) D-rings are used for fall protection. They slide on impact, keeping the worker in an upright position.



Class AD Suspension and Controlled Descent

Class AD harnesses are used to support and hold a worker while being raised and lowered. There is one sternal (front) D-ring and one dorsal (back) D-ring. The sternal D-ring is used for attachment to a descent device.



Class AE harnesses are designed to raise or lower a worker through a confined area. Shoulder D-rings serve as anchorage points for attaching an extraction yoke or other rescue device. The D-rings slide on the shoulder strap for optimal positioning of the worker.



Class AL Ladder Climbing

Class AL harnesses are designed for use with a certified fall arrester that travels on a vertical lifeline or a rail. Sternal (front) D-rings are used for attachment to the vertical system.



Class AP harnesses will hold and sustain a worker at a specific location, allowing full use of the hands, while limiting any free fall to two feet or less. Side D-rings at waist level are used for positioning and restraint.

The Bottom Line

Always follow the manufacturer's instructions for the proper selection, inspection, use, and maintenance

of your equipment.

Note: Instructor Guided Full Body Harness Inspection

• Prior to donning the harness for the harness suspension, the harness to be worn will be inspected by the student with guidance from the instructor.

Full Body Harness Donning

- The strongest part of your body is located where the two biggest bones (Femur and Pelvis) are surrounded by the biggest muscles in your body.
- To ensure that arrest forces are directed upward into the buttocks. It is important to follow this sequence of steps when donning your full body harness.

Step 1: Sub-Pelvic Strap.

- Remember the goal is to ensure that arrest forces are directed upward through the sub-pelvic strap ("Butt Strap") into the buttocks. Positioning of the sub-pelvic strap is critical for safety.
- The sub-pelvic strap is raised or lowered by adjusting the length of your shoulder straps.
- Ensure the sub-pelvic strap is just below the buttocks. If the sub-pelvic strap is too low it will not "grab" your buttocks during the fall and will allow the arrest force to impact the worker's groin through the leg straps. If the sub-pelvic strap is too high the same result may occur.
- After you have adjusted the sub-pelvic strap, ensure your shoulder straps are the same length and the ends are across from each other. That will ensure your sub-pelvic strap goes straight across just below your buttocks.
- Be sure to control the extra webbing from your shoulder straps with the webbing-stays (keepers).

Full Body Harness Donning (continued)

Step 2: Leg Straps

- The purpose of your leg straps are to hold the sub-pelvic strap in place.
- Once the sub-pelvic strap is in place, bring the leg straps through between your legs, make sure the leg straps are not crossed over or twisted.
- The leg straps should be snug, but not too tight.
- When properly adjusted you should be able to slide your flat hand through between your thigh and the leg strap, but not be able to bring your hand in a fist position back through between the strap and your leg.
- Leg straps should be equally tensioned on each side.
- Be sure to control the extra webbing from your leg straps with the webbing-stays (keepers).

Step 3: Chest Strap

- The purpose of your chest strap is to keep you in the harness when you fall.
- The chest strap needs to be positioned correctly and tensioned properly so that you cannot move your shoulder straps off your shoulders.
- The chest strap needs to be on top of your chest, but no higher than your arm pit.
- Test by pulling your shoulder straps outward toward your shoulders, you should not be able to get the shoulder straps off your shoulders.
- Be sure to control the extra webbing from your chest strap with the webbing-stays (keepers).

Full Body Harness Donning (continued)

Step 4: D-Ring Positioning

- The D-Ring used for personal fall arrest or Fall Restraint is the dorsal D-ring.
- It must be located in the centre of your back between your shoulder blades.
- The height of the D-Ring can be adjusted by pulling up or down one side at a time.
- The D-ring can be centred by lining up indicators on either side of the straps on your back.

Step 5: Partner Check

- A partner check should be conducted to ensure all components are in the right position and straps are not crossed over or twisted.
- Adjustment of the D-Ring is best done by a partner.
- Your partner can check the D-Ring position by placing their hands on your back with their fingertips at the top of your shoulders and joining their thumbs. Where their thumbs join is where the bar on the D-Ring should be.
- Your partner can line up indicators on the back straps and verify the D-Ring is in the centre of your back. If your partner has trouble centring the D-Ring they should check the shoulder straps and ensure they are adjusted symmetrically.

Incident Review

August 2008 – Edmonton Law Courts Building

A swing-stage cable broke leaving two window washers suspended for at least 20 minutes, 5 stories above the ground.

Full Body Harness Suspension

- Harness Suspension is voluntary but strongly encouraged as it provides experience to help understand why proper donning of the harness is so important.
- Instructor must remind the students that safety violations are strictly prohibited (horseplay, swinging, pushing, etc.) and will result in an automatic fail of the course without a refund.
- Instructor has verified the system being used is safe.
- Instructor has verified there is no reason the student should not suspend in the harness.
- Instructor verifies the students harness is being worn properly.
- Student being suspended must be directly below the anchor.
- Student connects snap-hook to harness.
- Instructor reminds the student not to drop into the harness but sit down slowly.
- Student sits down gently in the harness and brings knees toward the chest.
- Maximum suspension time 1 minute
THIS PAGE LEFT BLANK INTENTIONALLY

Chapter 8 Exercise:

- 31. What can you do to reduce the effects of suspension trauma?
- (a) Push against or stand on something.
- (b) Keeping the legs moving can be beneficial.
- (c) Use of suspension straps or simply a loop in a rope.
- (d) All of the above

32. True or False?

Arrest forces should be directed upward through the sub-pelvic strap ("Butt Strap") into the buttocks.

33. True or False?Positioning of the sub-pelvic strap is critical for safety.

34. Which is the correct sequence of adjustments in donning a full body harness?

(a) Leg straps, Sub-pelvic strap, Chest strap, D-Ring, Partner Check

- (b) Sub-pelvic strap, Chest strap, Leg straps, D-Ring, Partner Check
- (c) D-Ring, Partner Check, Sub-pelvic strap, Leg straps, Chest strap,
- (d) Sub-pelvic strap, Leg straps, Chest strap, D-Ring, Partner Check

35. True or False?

A partner check should be conducted to ensure all components are in the right position and straps are not crossed over or twisted.

Summary

What was covered in Chapter 8?

- Mechanism of injury in falls.
- Suspension trauma, and how to reduce the effects.
- Criteria and importance in selecting the correct harness.
- Donning a harness correctly and understand how a properly fitted and adjusted harness can reduce the risk of injury.
- Safety procedures to be followed before and during the harness suspension.

Chapter 9: Emergency Preparedness and Response

Goal: The student will understand emergency response requirements at work sites.

Objectives:

1. The student will be aware of the employer's and employee's responsibilities with respect to emergency response procedures.

2. The student will understand the steps taken in the initial response to a worker who has fallen.

Rescue

The employer must have a written fall protection plan for a workplace if:

- Work is being done at a location where workers are not protected by permanent guardrails, and from which a fall of 7.5 m (25 ft) or more may occur, or
- Work procedures are being used in place of one of the other fall protection systems
- The fall protection plan must be available at the workplace before work with a risk of falling begins and include the procedures for rescue of a worker who has fallen and is suspended by a personal fall protection system or safety net but is unable to self-rescue.

Where a fall protection plan may not be required by the Regulation, the employer must still consider the need for rescue or evacuation.

Risk assessment

- The employer must conduct a risk assessment in any workplace in which a need to rescue or evacuate workers may arise.
- If the risk assessment required by subsection (1) shows a need for evacuation or rescue, appropriate written procedures must be developed and implemented, and a worker assigned to coordinate their implementation.
- Written rescue and evacuation procedures are required for but not limited to:
 - work at high angles,
 - work in confined spaces or where there is a risk of entrapment,
 - work with hazardous substances,
 - underground work,
 - work on or over water, and
 - workplaces where there are persons who require physical assistance to be moved.

Emergency procedures

- Emergency means of escape must be provided from any work area in which the malfunctioning of equipment or a work process could create an immediate danger to workers and the regular means of exit could become dangerous or unusable.
- Emergency exit routes must be designed and marked to provide quick and unimpeded exit.
- At least once each year emergency drills must be held to ensure awareness and effectiveness of emergency exit routes and procedures, and a record of the drills must be kept.
- Workers designated to provide fire prevention, fire fighting, rescue, or evacuation services must be adequately trained as required under Parts 31 and 32 of the regulations.

Work at High Angles

- In certain locations and situations, the employer may meet the need for rescue procedures by participating in the Industrial High Angle Rope Rescue Program.
- Work at "high angles" means a worker is in a position that cannot be reached by a standard stairway or elevator, and thus an injured worker on a stretcher could not be brought to a location accessible by an ambulance crew without use of specialized rescue equipment and techniques.
- Section 4.13(3)(a) states that written rescue and evacuation procedures are required for work at high angles.

Industrial High Angle Rope Rescue Program

Introduction

- Rescue of a worker at a high elevation can be effectively done in a variety of ways, depending on the circumstances at the workplace. For example, on a construction site, the personnel hoist may be used, or a "dedicated emergency platform" (DEP) hoisted by a tower or mobile crane may be used to remove an injured worker.
- Some work activities, for example window washing, swing stage work, and tower crane operation result in a need for high angle rescue capability to rescue or remove a stranded or injured worker.
- An employer may develop its own high angle rescue capability, and this requires specialized equipment, training, and practice.
- As an alternative, for a workplace located in an area serviced by a local fire/rescue department, and where the department has high angle rope rescue capabilities, the employer may be able to arrange for the department to provide rescue services for the employer's operation.

Notice of Rescue Service for Short-Term Work

- If an employer wants to use the local municipal fire/rescue department as a high angle rope rescue service provider, the employer must notify the department in advance, and ensure the department is capable and prepared to provide the required services.
- If the employer's activity is a short-term/transient activity such as window cleaning or other work using suspended staging, or tower crane erection, the employer may use the following form, "Notice of Rescue Service for Short-term Work," to document notification of the fire/rescue department.
- The employer should keep a copy of the completed form as part of fall protection records.

Application for Industrial Rescue Service

• For workplaces with a longer term need for rescue capability to be available, particularly where site conditions are regularly changing such as at a high-rise construction project, a more formal written agreement needs to be established between the employer and the fire department.

Rescues Outside Service Area by Other Acceptable Means

- If a workplace is located outside the service area of a municipal fire/rescue department providing high angle rope rescue service, the employer must provide for any necessary high angle rescue requirements by other acceptable means.
- Evacuation or rescue of a worker at high angles is a high-risk operation requiring training and equipment to match the nature of the situation.
- The required competencies of the person or persons involved in conducting the rescue and the required equipment are dependent on the circumstances identified in the risk assessment and need to be part of the site-specific rescue plan.
- The site-specific rescue plan must include equipment and procedures specific to the operation.
- Workers who execute the site-specific rescue plan must have appropriate training and equipment which provides them with the competencies and capabilities necessary to conduct the rescue in a safe manner without endangering either the worker(s) being rescued or the worker(s) performing the rescue.

Use Of 9-1-1 For Rescue

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

Verify Resources and Capabilities of Local Emergency Services

• 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 (~330 ft.) above ground level following the failure of a swing-stage 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.

Evacuation by air

• Where a risk assessment made under section 4.13 concludes that removal by air is the most practicable method of evacuating injured workers, the employer's written procedures must conform to Transport Canada as well as WorkSafeBC requirements. Refer to Part 29 of the *Regulation*.

Emergency Response Plan

- An emergency response plan must be established for responding to an emergency that may require rescue or evacuation.
- Affected workers should be involved in establishing the emergency response plan.
- The emergency response plan needs to be kept up to date and be current.

Elements of an ERP

- Identification of potential emergencies.
- Procedures for dealing with the identified emergencies.
- Identification of, location of and operational procedures for emergency equipment.
- Emergency response training requirements; (e) the location and use of emergency facilities.
- Location and use of emergency facilities.
- Fire protection requirements.
- Alarm and emergency communication requirements.
- First aid services required.
- Procedures for rescue and evacuation.
- Designated rescue and evacuation workers.

Initial Response to A Worker Who Has Fallen

Speed is of the essence; this is truly a life-threatening emergency. But the actions taken must be purposeful and well thought out. A well-documented plan must be developed, shared with anyone who it may impact (management, workers, responders, etc.).

- 1. Warn others, ensure the safety of all workers.
- 2. Call for help, initiate the site emergency response plan (ERP) and Rescue Plan.
- 3. Assess the situation and resources available to respond.
- Maintain the safety of the emergency site where the incident has occurred by identifying and controlling any critical hazards.
- Have a worker meet emergency responders and show them a safe way in to access the emergency site.
- Allow a co-worker to maintain contact with the casualty to provide reassurance and remind the casualty what to do while waiting to be rescued.
- Do not allow co-workers who are not properly equipped or trained to perform the rescue.
- Do not experiment with equipment or procedures that have not been thoroughly thought out and with which training and drills have been carried out.
- Know the limitations of lifts and other equipment. Platform must accommodate a casualty laying down and have sufficient capacity for the casualty and rescuers.
- 4. When safe to do so, proceed with the rescue, or wait for emergency services to arrive.
- Workers involved in rescue must be competent and properly equipped.
- Once the rescue is complete, take the casualty to a safe location.
- 5. Persons qualified in first-aid should provide first-aid until arrival of emergency medical personnel. There is no first-aid treatment protocol specifically for a worker who has been suspended in a harness.
- If a spinal injury is suspected the first aider should maintain spinal motion restriction.
- Treat for shock by providing warmth.
- If conscious, place the patient in a position of comfort.
- If unconscious, place the patient in recovery position.
- Watch for vomiting, an unconscious patient is at risk of aspiration (vomit entering the airway). An unconscious patient who is vomiting should be rolled onto one side. Take extra care in rolling a patient with a suspected spinal injury.
- Constantly monitor the patient.
- 6. Ensure all appropriate authorities have been notified as per the ERP.
- Document, document, document
- Cooperate fully with police, and/or OH&S Investigators.

Follow-Up

- Ensure co-workers are debriefed and receive any assistance they may require. Police services may be able to offer assistance through victim services.
- Before allowing work to begin after an incident, replenish all first-aid and rescue supplies and equipment.
- When appropriate, review the incident and ensuing response, and make any revisions to the ERP or Rescue Plan that may be necessary.

Chapter 9 Exercise:

36. True or False?

The employer must conduct a risk assessment in any workplace in which a need to rescue or evacuate workers may arise.

37. True or False?

If the risk assessment shows a need for evacuation or rescue, appropriate written procedures must be developed and implemented, and a worker assigned to coordinate their implementation.

38. Workers performing rescue or evacuation must:

(a) Wear personal protective clothing and equipment appropriate to the hazards likely to be encountered.

(b) Visually and physically inspect ropes and associated equipment after each use for rescue, evacuation or training purposes.

(c) Maintain communications with the support persons.

(d) All of the above.

39. If workers are required to work in places from which they could fall and drown, and are not protected by guardrails or other means of fall protection permitted by this Regulation, the employer must provide:

(a) a suitable rescue boat, equipped with a boat hook, available at the site and capable of being used for rescue at all times,

(b) a buoyant apparatus attached to a nylon rope not less than 9 mm (3/8 in) in diameter, and not less than 15 m (50 ft) in length, and

(c) a sufficient number of workers who are available when work is underway to implement rescue procedures and who are properly equipped and instructed in those procedures.

(d) All of the above.

40. True or False? Written rescue and evacuation procedures are required for work at high angles.

41. True or False?

If a workplace is located outside the service area of a municipal fire/rescue department providing high angle rope rescue service, the employer must provide for any necessary high angle rescue requirements by other acceptable means.

42.True or False?

The employer must ensure that workers involved in the rescue plan/procedures are trained and competent in the use and implementation of all high angle rescue equipment and procedures.

43. True or False?

A rescuer's training and experience doesn't matter; this is a life-threatening situation and the most important thing is to help the casualty as quickly as possible.

44. True or False?

Before allowing work to begin after an incident, replenish all first-aid and rescue supplies and equipment.

Summary:

What was covered in Chapter 9?

- Employer's and employee's responsibilities with respect to emergency response procedures.
- The steps taken in the initial response to a worker who has fallen.

 	 	<u> </u>