



Department of Facilities
Management

Occupational Health and Safety

Fall Protection Program

1.0 INTRODUCTION

This program has been developed to provide guidance to those managers and supervisors whose employees are involved in working at height. The ability to identify and assess the fall related hazards associated with jobs of this nature and implement appropriate control measures is critical to ensuring the safety of the employees performing the work.

2.0 PURPOSE

The purpose of this program is to:

- ensure the health and safety of employees
- eliminate or minimize the risk associated with a hazard of falling.
- ensure that any work involving a hazard of falling at any Dalhousie University campus or facility is done in compliance with the OHS Act, the Fall Protection and Scaffolding Regulations, all appropriate CSA Standards and this program.
- ensure the proper use, maintenance and storage of fall protection devices and personal protective equipment.
- ensure that all employees working at height where there is a hazard of falling have the training and knowledge to do so safely and effectively.

3.0 APPLICATION

This program applies to all work at height performed on Dalhousie University properties by Facilities Management employees, or contractors, where a falling hazard exists.

4.0 DEFINITIONS

“anchor point” means a component that is attached to a structure and to which fall protection or scaffolding components are secured.

“fall arrest system” means a fall protection system consisting of an assembly of components that arrests a persons fall when properly assembled, used together and connected to a suitable anchorage.

“fall protection system” means any secondary system that is intended to prevent a person from falling or arrests a fall that occurs, and includes guardrails, temporary flooring, travel restraint systems, personnel safety nets and fall arrest systems .

“free fall distance” means the actual distance fallen and is the measurement between the position of a harness’ D ring before and after a fall.

“full body harness” means a body holding device, similar to a parachute harness, that transfers suspension forces or impacts during a fall arrest to a person’s pelvis or skeleton.

“guardrail” means a fall protection system consisting of vertical and horizontal members that are capable of withstanding concentrated forces (see regulations), warn of a fall hazard and reduce the risk of a fall.

“lanyard” means a flexible line or strap used to secure a full body harness to an energy absorber, fall-arrester, lifeline or anchorage.

“lifeline” means a component of a fall protection system consisting of a vertical or a horizontal lifeline.

“personal safety net” means a fall protection system that uses at least one net to stop a person who is falling before the person makes contact at lower level or obstruction.

“ropegrab” means a mechanical fall arrest device that is attached to a lifeline and a lanyard and locks itself immediately on the lifeline in the event of a fall.

“safe surface” means an area that meets all of the following criteria:

- It is large enough and strong enough to adequately support a person who falls,
- It is level enough to prevent a further fall by a person who has fallen.

“safety belt” means a belt worn by a person as a means of fall protection. (Safety belts are NEVER to be considered a part of a fall arrest system.)

“static line” means a rope that is attached horizontally to two or more fixed anchor points, and, to which a fall arrest system is attached.

“travel restraint system” means a fall protection system that will prevent a person from reaching an unprotected edge or opening.

‘work platform’ means a raised temporary horizontal working surface that provides access and support to a person at a workplace.

5.0 REFERENCES

The following is a listing of the legislation, regulations and standards that apply to fall protection.

- Nova Scotia Occupational Health and Safety Act
- Nova Scotia Workplace Health and Safety Regulations
- Nova Scotia Fall Protection and Scaffolding Regulations
- CSA Standard Z259.16, Design of Active Fall Protection Systems
- CSA Standard Z259.1, Body Belts and Saddles for Work Positioning and Travel Restraint
- CSA Standard Z259.11, Energy Absorbers and Lanyards
- CSA Standard Z259.13, Flexible Horizontal Lifeline Systems
- CSA Standard Z259.2.1, Fall Arresters, Vertical Lifelines and Rails
- CSA Standard Z259.2.2, Self Retracting Devices for Personal Fall Arrest Systems
- CSA Standard Z797, “Code of Practice for Access Scaffolds”
- CSA Standard Z259.12, Connecting Components for Personal Fall Arrest Systems
- ANSI A10.11, American National Standard for Construction and Demolition Operations - Personal Safety Nets
- All Manufacturer’s Specifications and Standards

Note: Depending on the work being performed and the equipment being used additional regulations and CSA or other Standards may be applicable.

6.0 RESPONSIBILITIES

All employees shall ensure that they are aware of, and comply with, any responsibilities listed in the Dalhousie University Occupational Health and Safety Program that apply to this type of work. The following individuals will be held accountable for ensuring compliance with the additional responsibilities listed below.

6.1 Supervisors shall be responsible for ensuring:

- that where there is a risk of falling associated with work at height the work is performed in compliance with Part 21 of the Workplace Health and Safety Regulations, this Program and the relevant CSA standards.

- that only properly trained and certified employees are allowed to erect and / or use scaffolds and that they have received fall protection training.
- that any employee that performs work at height, or may be required to undertake rescue operations involving employees working at height, receives the necessary training as specified by this program, the regulations and the appropriate CSA standards.
- that depending on the height of the working surface either a safe work plan or a safe work procedure is completed in writing.
- all pertinent fall prevention is communicated to their employees.
- that employees follow all procedures and practices applicable to this program or associated with the work being performed.
- that all contractors and / or sub-contractors performing work at height at Dalhousie University have their own fall protection program.

6.3 The Working Foreperson or Employee in charge of a work site shall:

- ensure that only competent employee's that have been properly trained in the use of fall protection equipment and devices perform work at height.
- ensure that a rescue plan and procedures are prepared for each work site.

6.4 Employees shall be responsible for:

- performing all work at height in compliance with this fall protection program and all relevant regulations and standards.

6.5 Program Managers are responsible for:

- ensuring they receive user scaffold training as specified by CSA Z797-09 Code of Practice for Access Scaffolds before accessing any scaffold system.

6.6 Contractors shall be responsible for:

- providing a copy of their Fall Protection Program / Plan along with proof of training for all employees, working at Dalhousie, for review by Dalhousie EHS and where the Dalhousie University requirements exceed those of the contractor, the University requirements shall take precedence.

7.0 WHEN FALL PROTECTION MUST BE USED

One, or more, of the types of fall protection specified in Section 10 of this program shall be used at all times when an employee:

- is exposed to a hazard of falling where the work area is **3.0 meters (10.0 feet), or more**, above a safe surface or above water,
- is exposed to hazard of falling less **than 3.0 meters** but the work area is above a surface or thing that could cause injury to an employee upon contact,
- is working above an open pit, vat or tank containing hazardous material,
- is working at the perimeter or other side of a work area
- may fall through an opening in the work surface; or,
- is performing work from a ladder and it is not practical for an employee to maintain three point contact while performing the work, fall protection is required only where and to the extent practical; or,
- as may be required by changes to the regulations or as ordered by a safety officer.

8.0 EXCEPTIONS TO THE REQUIREMENT FOR FALL PROTECTION

Fall protection is not required for a person who is entering or exiting a work area by a safe means of access and egress.

As well, in the following circumstances fall protection is required only where reasonably practicable and to the extent it is reasonably practicable.

- If work must be performed on or from a vehicle or other type of mobile equipment.
- If it is not reasonably practicable to perform work other than from a ladder and it is not reasonably practicable for the person performing the work to maintain adequate contact with the ladder while performing the work.
- If the density of tree branches prevents a Grounds and Horticulture employee who from “crotching” when doing pruning work on trees.

Refer to Sections 21.2 (3), (4) and (5) of the Nova Scotia Occupational Health and Safety Regulations for further information and clarification.

If it is not reasonably practicable to use fall protection in circumstances listed above the supervisor and employees who will perform the work must ensure that alternate control measures are used to reduce, to the extent reasonably practicable, the risk of falling. Any alternate control measures developed must be equal to, or greater than, the protection provided by fall arrest equipment.

9.0 HAZARD, IDENTIFICATION ASSESSMENT AND CONTROL

If the job to be performed requires work to be done at height a Fall Protection Worksite Hazard Assessment form must be completed by the supervisor and employees performing the work. This is in addition to the Pre Job Hazard Assessment that must be completed for the overall worksite.

The completion of this form ensures specific fall related hazards, that might otherwise be overlooked, are identified and assessed and that appropriate control measures are implemented to deal with each hazard. The information recorded on this form can be use to help you prepare either a Fall Protection Safe Work Procedure or a Fall Protection Safe Work Plan depending on the height at which the work will be performed.

10.0 TYPES OF FALL PROTECTION TO BE USED

When a hazard assessment indicates the need for fall protection at least one, or more, of the following types of fall protection must be used to ensure the safety of the employees performing the work.

- Guardrails
- Temporary flooring
- A personnel safety net
- A travel restraint system
- A fall arrest system

The type of fall protection selected must be appropriate for the hazards identified in the work site hazard assessment and / or addressed in either the required fall protection safe work procedure or fall protection safe work plan.

11.0 FALL PROTECTION SAFE WORK PROCEDURES AND FALL PROTECTION SAFE WORK PLANS

Written fall protection safe work procedures and / or written fall protection safe work plans are not required if all employees performing the work at height are protected by a permanent guardrail, or, the work is performed from a lift truck work platform, an elevating work platform, a crane supported work platform or a mast climbing platform and any of the employees working on such platforms are using adequate fall protection.

A written fall protection safe work procedure must be completed for the work that will be performed if fall protection is required and the fall distance at a work site is less than 7.5 meters.

A written fall protection safe work plan must be completed for the work that will be performed if fall protection is required and the fall distance at a work site is 7.5 meters or greater.

The appropriate Facilities Management form should be used in each of the above cases. The information entered on either form must be based on a completed hazard assessment of the conditions and work to be performed at each work site. The Fall Protection Worksite Hazard Identification and Assessment Form must be used for this purpose.

The supervisor responsible for the job must review the completed fall protection safe work procedure or plan with employees before any work begins. A copy of the procedure or plan must be readily available at the work site for the entire time such work is being performed.

If there are any changes in work site conditions, or, to the fall protection system(s) being used, work must be stopped and either the fall protection safe work procedure or plan in use must be updated.

Any time a fall protection safe work procedure or plan is updated the changes must be reviewed with workers before work resumes.

12.0 PROPER USE OF FALL PROTECTION

When using any of the fall protection measures specified in Section 10.0 employees shall ensure that they are erected, installed, assembled, used, handled, stored, designed, adjusted, maintained, repaired, inspected, serviced, tested, cleaned, and dismantled in accordance with the appropriate regulations, manufacturer's specifications and / or the latest version of the appropriate CSA standards.

Refer to the Nova Scotia Workplace Health and Safety Regulations, Sections 21.5 to 21.9 for further guidance on the use of each type of fall protection.

13.0 WORK POSITIONING SYSTEMS

Employees must use a work positioning system in combination with a fall arrest system when:

- the centre of gravity of the person using the work positioning system extends beyond the edge from which the person could fall;
- the state or condition of the work surface creates a slipping or tripping hazard.

Under no circumstances is a work positioning system to be used, by any Facilities Management employee, as a means of fall arrest.

14.0 TRAVEL RESTRAINT EQUIPMENT

Travel restraints are to be used by employees to prevent them from falling. Examples of fall restraints systems are:

- work positioning (See section 13.) that are attached to an anchor and allows you to work safely with both hands.
- a travel restriction system such as guardrails which provide a high degree of safety if they are installed properly and are highly recommended when ever it is possible to install such a system, or;
- personal fall protection equipment that is attached to an anchor point and prevents you from reaching the edge of a surface where it may be possible for a fall to occur.

Travel restraint involving personal fall protection must include the use of a lanyard or lifeline and an adequate anchorage point. The length of the lanyard or lifeline that is chosen for use must prevent the user from getting within 1.8 meters (6.0 feet) of an edge or opening.

15.0 HORIZONTAL AND VERTICAL LIFELINES

Any time a horizontal lifeline is used as a component in a fall arrest system it must be designed and installed in compliance with CSA Z259.16, "Design of

Active Fall Protection Systems” and it must be used, certified and made of material in compliance with CSA Z259.13, “Flexible Horizontal Lifeline Systems”.

Any vertical lifeline used as a component in a fall arrest system must be certified and used in compliance with CSA Z259.2.1, “Fall Arresters, Vertical Lifelines and Rails”.

16.0 ANCHORAGES AND ANCHORAGE CONNECTORS

It is not uncommon for employees to select a part of a structure located, more or less, in the area where work will be performed as an anchorage for a travel restraint or fall arrest system. It is critical for employees to remember that such anchor points are not likely to meet the technical requirements established by the Canadian Standards Association. Accordingly, it is important for employees that will be using fall protection equipment to be able to assess the strength and stability of an anchor point as well as its proper location in relation to the work area.

Any anchorages used by Facilities Management employees as components of a fall protection system must be capable of withstanding 22 kN for a non-engineered anchorage, or, 2 times the maximum arresting force anticipated for an engineered anchorage. The anchorages must be able to withstand these forces in any direction from which the force may be applied.

Anchorage must be located such that they will help reduce free fall, swing fall and help prevent a falling employee from hitting hazardous surfaces or objects during a fall. Anchorages, anchorage connectors, connection points and connectors must meet the requirements of CSA Standard Z259.15-12 Anchorage Connectors.

If necessary, ask for the assistance of a department engineer in determining the safety of a proposed anchor point.

17.0 CALCULATING FALL DISTANCE

When a fall arrest system is selected as the type of fall protection to be used for a particular job, great care must be taken to confirm the distance from a specified reference point such as the working platform or anchorage of a fall-arrest system, to the highest obstruction that a worker might encounter during a fall, and, in selecting the proper equipment to ensure safe fall clearance.

Normally, clearances shall be referenced to the working platform, except when it may be necessary for portable or temporary systems to reference clearances to the anchorage. Clearance requirements shall account for the worst-case total of

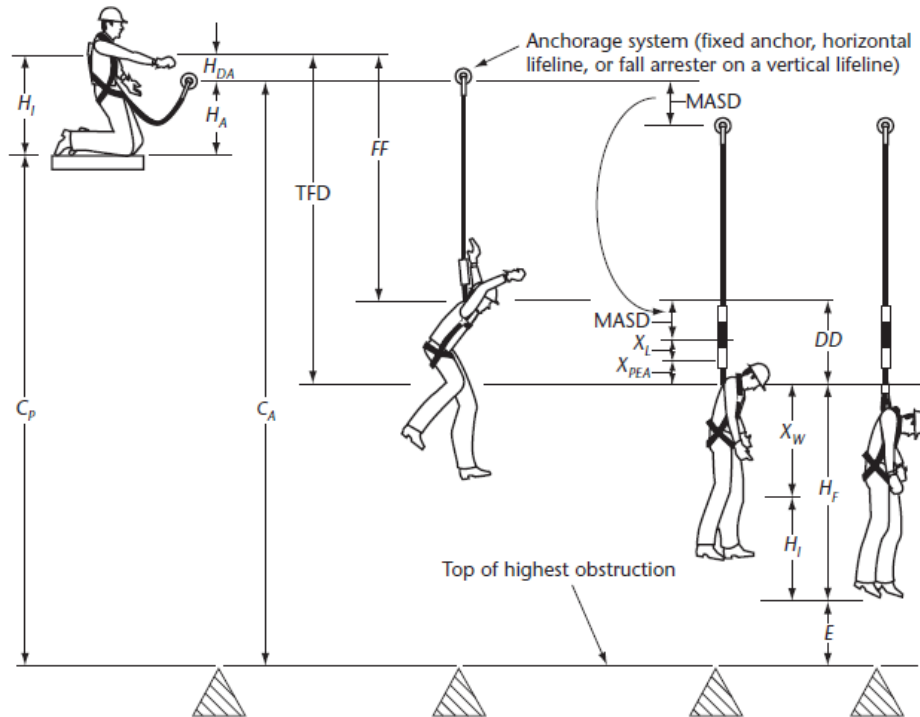
free-fall distance, deceleration distance, stretch out, applicable swing-drop distance, and the specified safety margin.

Deceleration distance is the distance over which a fall-arrest system reacts to bring a falling worker to a complete stop. Deceleration distance shall include any applicable stretch of lifelines and lanyards, the maximum anchorage system deflection, and deployment distance of personal energy absorbers (PEAs) and clutching of self retracting lanyards (SRLs).

A personal fall arrest system must be planned, designed, and installed to provide sufficient clearance distance so that a worker cannot hit the ground or an object or level below the work area. Various factors must be accounted for in typical clearance calculations, including: the sag of the lifeline (if a horizontal life line is used), the length of the lanyard, shock absorber (deceleration distance), harness stretch, height of the worker, and a safety factor providing clear space between the worker and the lower surface or object.

NOTE: The following diagrams provide information about the calculation of clearance distances for free falls, swing falls and horizontal lifeline sags and forces. CSA Standard Z259.16 – 04, Design of Active Fall Protection Systems must be referred to for complete and accurate information.

17.1 Free Fall Clearances (Excluding Swing Falls)



Legend:

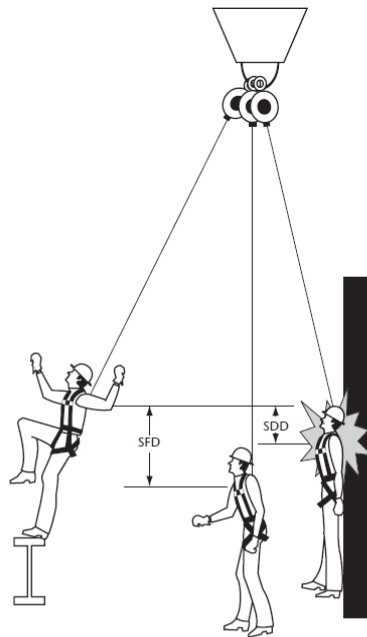
- C_A = required clearance below the anchorage
= $FF - H_{DA} + DD + H_F + E$
- C_P = required clearance below the platform
= $FF + DD + X_W + E$
= $C_A - H_A$
- DD = deceleration distance
= $MASD + X_L + X_{PEA}$
- E = safety margin
- FF = free fall
= $FF_A + FF_L + FF_C$ (see Figures 1, 2, and 3)
- H_A = height of anchorage above the working platform
- H_{DA} = height of D-ring above the anchorage (H_{DA} is negative if the D-ring is initially below the anchorage)
- H_F = final height of D-ring (above the worker's toes) at fall arrest
- H_I = initial height of D-ring (above the working surface) at start of fall
- $MASD$ = maximum anchorage system displacement (dynamic deflection of horizontal lifelines, flexible anchorages, vertical lifelines, etc.)
- TFD = total fall distance (of the worker's dorsal D-ring)
= $FF + DD$
- X_L = stretch of the lanyard
- X_{PEA} = deployment of the personal energy absorber or clutching self-retracting lanyard
- X_W = stretch out (due to D-ring flip and slide, harness stretch, and straightening of the worker's body)

Figure 6
Clearances (excluding swing-fall distance)
(See Clauses 3, 8.1, 8.2.1, 8.2.2.1, 8.2.3, and 8.2.6.)

17.2 Swing Falls

Swing fall hazards are a reality if work is not performed as directly under an anchorage point as possible. In fact as an employee moves further away from the spot directly under and anchor point they increase the potential for swinging like a pendulum if they fall. If there are objects extending vertically into the range of the arc of the swing the employee can suffer serious injury even if their fall is arrested.

In a work area where some degree of swing is likely every effort must be made to choose an anchor point that will direct the swing away from objects that could be harmful. Always choose an anchor point that will ensure the least amount of swing and if multiple anchor points are available move to a new anchor point, if necessary, in order to stay as directly under an anchor point as possible.



Legend:

SDD = swing-drop distance (drop in height of D-ring from the onset of the swing to the point where the worker may impact any structure)

SFD = swing-fall distance (drop in height of D-ring from the onset of the swing to the lowest point it reaches during the swing)

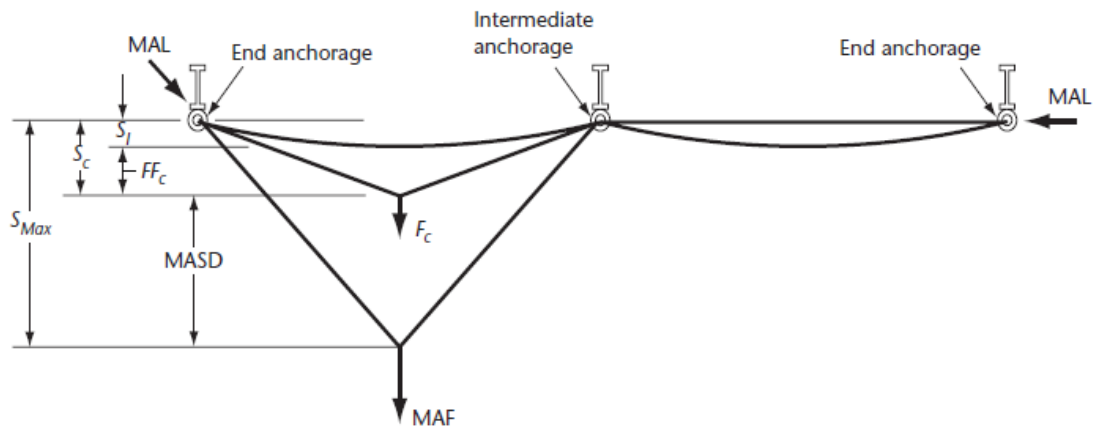
Note: SDD and SFD are calculated assuming a circular (pendular) motion of the worker's D-ring on a fixed and taut length of lifeline. They do not include a drop in height due to free fall or deceleration distance.

Figure 5
Swing falls

(See Clauses 3, 6.3, 8.2.1, and 8.2.4.)

For more information on swing falls refer to the appropriate clauses in the CSA Z259.16-04; Design of Active Fall Protection.

17.3 Horizontal Lifeline Sags and Forces



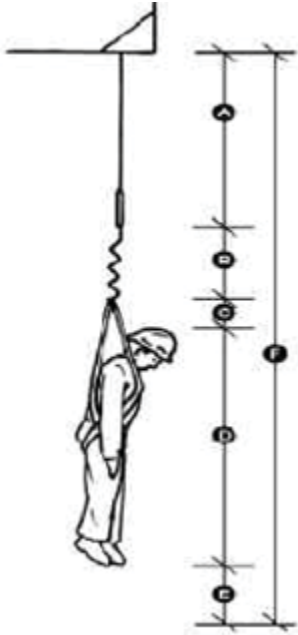
Legend:

- F_c = force required to pull slack out of adjacent spans and hold the initial length of cable into approximate straight-line cords (because this force is low, there is negligible worker deceleration prior to achieving cusp sag)
- FF_c = free-fall distance due to slack in the horizontal lifeline cable
- MAF = maximum arrest force
- MAL = maximum arrest load (a force vector co-linear with the cable)
- $MASD$ = maximum anchorage system deflection
= $S_{Max} - S_c$
- S_c = cusp sag of the horizontal lifeline (due to all slack being pulled out of adjacent spans and to the initial length of cable being pulled into approximate straight-line cords)
- S_1 = initial sag of the horizontal lifeline (due to self-weight being balanced by the pre-tension force)
- S_{Max} = maximum sag of the horizontal lifeline at fall arrest (due to the applied MAF)

Figure 3
Horizontal lifeline sags and forces
 (See Clauses 3, 8.2.2.4, 8.2.3.3, and 9.2 and Figure 6.)

17.4 Other Acceptable Methods of Calculating Clearance Distances

In compliance with Clause 9.3.6 of CSA Z259.16-04; Design of Active Fall Protection the following is an example of a simplified method for calculating clearance distances

	<p>Example: A worker is 1.8m (6ft) tall using a 1.8m(6ft) long lanyard. The combined weight of the worker, clothing and tool belt is at least 100kg (200 lbs).</p> <p>A = Length of lanyard – 1.8 m (6ft)</p> <p>B = 1.1m (3.5 ft) deceleration (shock absorber pulling apart)</p> <p>C = Harness stretch plus D-ring sliding – .45m (1.5 ft)</p> <p>D = Height of worker – 1.8m (6ft)</p> <p>E = Safety factor – clearance below feet of ~ 2-3 feet)</p> <p>F = A+B+C+D+E Overall minimum clearance is 6.0m (20ft)</p>
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18.0 WORKING ALONE

Employees are not to work alone when a falling hazard exists. A minimum of two people must be present at all times when a falling hazard exists and a fall arrest system or a travel restraint system must be used.

19.0 INSPECTION, MAINTENANCE, CLEANING, STORAGE of FALL PROTECTION EQUIPMENT

19.1 Inspection and Maintenance

Supervisors and employees shall ensure that lanyards, lifelines, full body harnesses, self retracting devices, self retracting lanyards and all other fall arrest equipment in use is inspected and maintained as specified in documentation provided by the manufacturer or as indicated on warning labels attached to each item.

Equipment must be carefully inspected, using Facilities Management Fall Arrest Equipment Checklists, by the user prior to each use to ensure that it is in good working condition.

If the pre-use inspection reveals that a piece of fall arrest equipment is in unsafe condition it must be tagged as DO NOT USE and removed from service. The equipment removed from service must either be disposed of or repaired by the manufacturer or someone authorized, in writing, by the manufacturer to perform repair work.

19.2 Cleaning

The manufacturer's recommendations regarding frequency of cleaning and the type of cleaning materials to be used must be followed all times.

19.3 Storage

The all arrest equipment manufacturers instructions with regard to storage must be followed at all times. As a minimum storage containers must protect equipment from moisture, abrasion, dirt, ultraviolet light, extreme temperatures and any other hazard or condition that could contribute to the deterioration of the equipment and compromise its integrity.

20.0 0 USE OF FALL PROTECTION EQUIPMENT BY CONTRACTORS

Contractors hired to perform work that will require the use of fall protection must provide their own fall protection equipment and their employees must be properly trained and competent in its use.

Department of Facilities Management fall protection equipment is not to be loaned to contractors except in the case of an emergency.

21.0 0 RESCUE PLANNING AND PROCEDURES

If an employee falls from a work surface they can face considerable danger as a result of injuries sustained during the fall or as a result of suspension trauma due to being suspended motionless in their fall arrest harness for an extended period of time while waiting to be rescued. Injuries suffered during the fall, the shock resulting from the experience of the fall, physical and environmental factors such as fatigue, dehydration, hypothermia, cardiovascular disease, respiratory disease and blood loss can increase the onset and severity of venous pooling and orthostatic intolerance (suspension trauma). The situation can be made worse by the harness constricting blood flow. The time spent in an unmoving suspended position with the legs below the heart is what kills.

In the case of most people, suspension trauma begins within 3.5 to 10 minutes therefore it is imperative that the period of time an employee remains suspended is reduced to the bare minimum. **The employee must be rescued as quickly as possible (within 10 minutes if possible) and provided with appropriate first aid and medical attention.** Once rescued the employee **must be slowly brought to a horizontal position.** This should be achieved over a 30 to 45 minute period by starting in a kneeling position, then going to a sitting position and then to a horizontal position.

NOTE: Part 21, Section 21.4 (3) (m) of the provincial Fall Protection regulations requires that rescue procedures must be developed as part of the safe work plan that must be prepared for a work area where fall protection is required and the fall distance is greater 7.5 meters. This program further requires that written rescue procedures must be developed for a work area where fall protection is required and the fall distance is less than 7.5 meters.

The Fall Protection Emergency Rescue Plan and Safe Job Procedure for Rescue from Heights has been developed to provide the guidance necessary to ensure the speedy, on site rescue, of any employee that falls.

To ensure that employees can react in a knowledgeable fashion to an emergency situation, management shall ensure that all employees taking fall protection training are also trained and well practiced in rescue procedures. Management shall ensure that all necessary rescue equipment is available for use by its employees.

At least once a year sufficient time should be set aside for employees to practice rescue procedures.

25.0 MEDICAL ATTENTION

An employee that has suffered a fall and has been suspended in their harness for a period of time is a true medical emergency, they must be checked out by an Emergency Health Services team and transported to hospital.

26.0 SELECTION OF FALL PROTECTION EQUIPMENT

Managers and supervisors must stay knowledgeable about the various fall protection products that are available, understand their functions and maintain an understanding of the many differences that exist in workplaces on Dalhousie University campuses in order to be capable of selecting the best fall protection equipment for their employees.