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Work Safe for Life

Low-Slope Roofing

Health & Safety Manual

2019 Edition

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November 2013
Revised, September 2019

978-1-894761-19-2

This manual has been developed to prevent injuries, illnesses, and fatalities to workers in the low-slope roofing sector. These workers are at risk of injury from hazards such as falls from heights, electrical contact, burns, struck-bys, overexertion, and heat stress.

Low-slope roofing work can also present a danger to the public:

- Overloading an area with counterweights or roofing equipment and materials can cause a roof collapse.
- Torching operations can cause fires.
- Materials can blow off the roof, injuring workers or the public below and causing property damage.

Special thanks to the Ontario Industrial Roofers Contractors Association and the Sheet Metal Workers International Association for their contributions to the creation of this manual.

This manual was developed, reviewed, and endorsed by the Roofers Labour-Management Health and Safety Committee in association with IHSA. IHSA would like to thank working committee members for contributing their knowledge, experience, and time to produce a health and safety manual that will benefit both labour and management in the low-slope roofing sector.

1 Rights and Responsibilities

Each workplace party has certain responsibilities that contribute to a safe and healthy workplace. Before beginning work, it is important for everyone to know and understand their rights and responsibilities.

This chapter deals with the various responsibilities and rights that are outlined in the *Occupational Health and Safety Act* (OHSA) and the Regulations for Construction Projects (O. Reg. 213/91). This is known as "the green book".

The Green Book

Legal Responsibilities

Implementing and following safe working procedures requires a working knowledge of the OHSA, which applies to all Ontario workplaces. It also requires knowledge of the relevant regulations under the OHSA that govern each sector.

Know the law

A ***competent person*** (OHSA, s. 1(1)) means a person who:

a. is qualified because of knowledge, training and experience to organize the work and its performance

b. is familiar with the OHSA and the regulations that apply to the work

c. has knowledge of any potential or actual danger to health or safety in the workplace.

Section 25(2)(i) of the OHSA requires employers to post a copy of the Act and any explanatory material prepared by the MOL outlining the rights, responsibilities, and duties of workers in a conspicuous location at the workplace. This information must be in English and in the majority language of the workplace.

Duties of a Constructor

The duties of a constructor are found in section 23 of the OHSA as well as other sections of the Act and in the Construction Projects regulation (213/91).

- Ensure that the project is supervised at all times.
- A project that lasts more than three months and has 20 or more workers, must have a Joint Health and Safety Committee (JHSC).
- If a JHSC is not required and there are more than five workers, the workers must choose a health and safety representative.
- Fill out a Ministry of Labour (MOL) Form 1000—Registration of Constructors and Employers Engaged in Construction.
- Keep a copy of all employer-approved forms (e.g., Form 1000) on site while employers are on the project.
- Send a Notice of Project form to the MOL if required. A Notice of Project form is required if the project is valued at more than $50,000 or falls under one of the other conditions in section 6 of the construction regulations.
- Develop written emergency procedures, make sure your employees and subcontractors know what they are, and post them on site.
- Make sure there is ready access to a telephone, a two-way radio, or other communication system in case of an emergency
- Report every fatality or other prescribed incident, such as a critical injury, to the MOL.
- Make sure that all workers on site are at least 16 years old.

Duties of an Employer

Many of the duties of an employer are specified in sections 25 and 26 of the OHSA. Some of the basic duties are as follows.

- Fill out a Ministry of Labour Form 1000—Registration of Constructors and Employers Engaged in Construction.
- If you have five or more workers, you must prepare and review annually a written Occupational Health and Safety Policy. You must also develop and maintain a program to implement the policy.
- Appoint a supervisor if five or more of your workers are on the project at the same time.

- Make sure that the workers on site are supervised at all times.
- Give workers the training that is required by law (on fall protection systems, WHMIS, etc.).
- If work must be done only by qualified workers, be sure the workers are qualified to do that work.
- Develop written procedures for rescuing a worker whose fall has been arrested (i.e., a worker hanging by a harness).

> ***Know the law***
>
> The Construction Projects regulation (O.Reg. 213/91, s.26.1) requires that workers be protected from falls by a guardrail system. If it is not reasonably possible to install a guardrail system, the following can be used:
>
> 1. A travel restraint system
> 2. A fall restricting system
> 3. A fall arrest system.

Duties of a Supervisor or Foreperson

Many of the duties of a supervisor are specified in section 27 of the OHSA. Some of the basic duties are as follows.

- Make sure that workers use the methods, procedures, and equipment required by the OHSA and regulations.
- Ensure that workers use or wear the equipment or clothing that the employer requires.
- Tell workers about actual or potential dangers.
- Give workers written instructions when required.
- Take every reasonable precaution to protect workers.

Duties of a Worker

Many of the duties of a worker are specified in section 28 of the OHSA.

> ***Know the law***
>
> The definition of ***worker*** (OHSA, s. 1(1)) includes unpaid interns, co-op students, and certain other learners and trainees participating in a work placement program. However, it does not include volunteers.

Some of the basic duties of a worker are below.

- Choose worker representatives for the Joint Health and Safety Committee.
- Tell your supervisor or employer about equipment problems or other hazards that could hurt you or other workers.
- Follow your employer's instructions to use or wear equipment, protective devices, or specific clothing.
- Never engage in horseplay on site (pranks, competitions, showing off your strength, roughhousing, or unnecessary running).

In addition to the duties outlined in the OHSA and applicable regulations, there may be jobsite-specific rules that workers must follow.

Rights of a Worker

Workers in Ontario have three basic rights:

1. **The right to know** what hazards are in the workplace (The employer has a duty to give that information to the Health and Safety Representative or JHSC.)
2. **The right to participate** in keeping the workplace healthy and safe by joining a Health and Safety Committee or becoming a Health and Safety Representative.
3. **The right to refuse unsafe work** that the worker believes endangers their health or safety or the health or safety of others.

Right to Refuse Unsafe Work

All workers should know about the local/on-site procedures for refusing unsafe work. Workers should talk to their supervisor first and try to resolve the problem before initiating the work refusal process.

If that proves unsuccessful, workers should follow the procedures for refusing unsafe work as outlined in section 43 of the OHSA.

> **REMEMBER:** Workers have a duty to report all potential hazards and unsafe conditions to their employer.

First Aid Requirements

First aid is emergency help given to an injured or suddenly ill person using readily available materials. The objectives are:

- preserve life
- prevent the injury or illness from becoming worse
- promote recovery.

Every employer covered by the *Workplace Safety and Insurance Act* (WSIA) is required to have a first aid station and trained first aid personnel at the workplace. Specific requirements are found in Regulation 1101: First Aid Requirements.

First AId Station

In general, a first aid station must:

- Be easily accessible
- Be in the charge of a worker who is certified to give first aid and who works nearby
- Contain a first aid box that has all the items required by the regulation (O. Reg., 1101)
- Contain a notice board to display the WSIB's *In Case of Injury at Work* poster, the valid first aid certificates of trained workers on duty, and an inspection card for the first aid box.

The contents of a station will vary according to the number of employees regularly employed at the workplace. On construction projects, it should be located in the site office. First aid kits should also be provided for service vehicles. Stations must be inspected at least quarterly and the inspection card signed and dated.

First Aid Kit and Eye Wash Station

Trained Personnel

Employers must ensure that first aid is provided by trained and knowledgeable workers. Since procedures may change from time to time, it is important that training be kept up-to-date. Recertification is usually required every three years.

Each first aid kit must contain a current edition of the St. John Ambulance First Aid Manual. The manual contains details of first aid treatment for a worker who is injured or who suddenly becomes ill. The first aid provider can use it as a reference guide.

First Aid Procedures

To ensure that an injured or ill worker receives appropriate and timely first aid treatment, an employer should have a written first aid procedure as part of their Health and Safety Program. The procedure should cover:

- Mandatory reporting and recording requirements
- Provision of first aid kits
- Availability of trained first aid providers and training recertification
- Transportation to medical treatment
- Document posting requirements.

For resources and templates to help develop a first aid procedure, visit the **Policy and Program Resources** section of the ihsa.ca website.

Learning first aid, CPR, and how to use an AED can help you save a life. Knowing how recognize the signs of someone who is in distress from a heart attack, stroke, or choking, for example, can help you get them the treatment they need quickly.

If you suspect someone is having a heart attack, look for the four Ps:

Pain – a continuous pain in the chest that may spread to the jaw, neck, or arms.

Pale skin

Pulse is rapid and weak

Perspiration

The signs and symptoms of a stroke vary depending on what part of the brain has been affected. Usually the symptoms show up on one side of the body. If you suspect a stroke, think **FAST:**

F – Facial droop. Ask the person to smile and watch the corners of their mouth.

A – Arm Drift. Have the person hold out both arms in front of them and see if one arm drifts back down or can't move at all.

S – Speech. Check if the person slurs their words, says the wrong words, or is able to speak at all.

T – Time. Get medical help immediately. The earlier a stroke is treated, the better the chance of survival and recovery.

For details on signs, symptoms, and treatment of illnesses and injuries related to heat or cold exposure, refer to Chapters 5 and 6 in this manual.

Post on Site Checklist

Construction employers are required by law to have the following documents and information posted or available at each jobsite:

- ☐ *Occupational Health and Safety Act and Regulations for Construction Projects* (the "green book")
- ☐ Regulation 1101 (First Aid Requirements)
- ☐ Company health and safety policy and program
- ☐ Company workplace violence and harassment policy
- ☐ Ministry of Labour inspector's orders and report
- ☐ Safety data sheet (SDS) of any hazardous physical product that may be used (available)
- ☐ Emergency response plan
- ☐ Fall arrest rescue procedures (available)
- ☐ *In Case of Injury* poster issued by the Workplace Safety and Insurance Board
- ☐ MOL's Health & Safety at Work: Prevention Starts Here poster
- ☐ MOL's "Notice of Project" (Form 0175) if the project is valued at more than $50,000 or falls under one of the conditions in section 6 of the construction regulations.
- ☐ MOL Form 1000 "Registration of Constructors and Employers Engaged in Construction" (available)
- ☐ Name of constructor and head office info
- ☐ Address and phone number of the nearest MOL office
- ☐ DANGER signs in hazardous areas
- ☐ Location of toilets and clean-up facilities
- ☐ Valid certificate of first aider on duty
- ☐ Inspection card for first aid box
- ☐ Employer records of first aid treatment given (available)
- ☐ Name, trade, and employer of (as applicable):
  - Health and Safety Representative
  - Joint Health and Safety Committee (JHSC).
- ☐ Emergency phone numbers and location of nearest hospital (map)

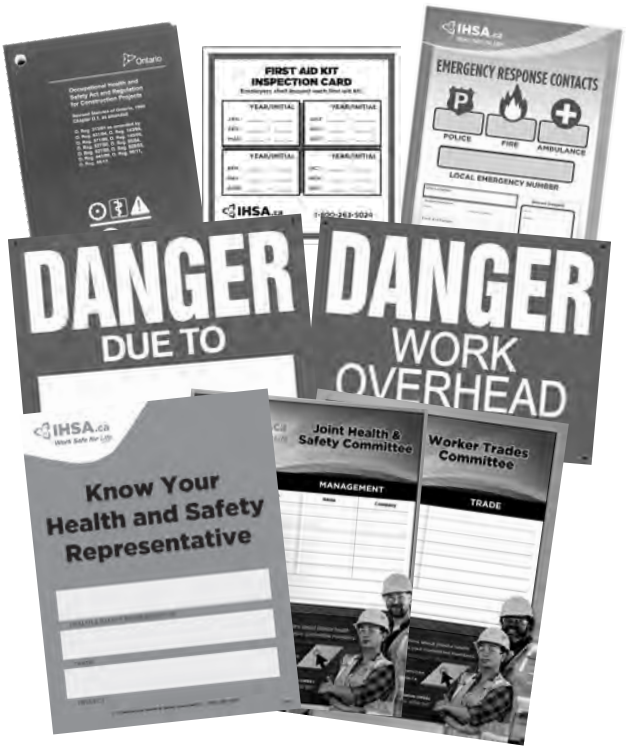
How IHSA Can Help

IHSA has the following products available to order from the **Products** section of our website to help companies comply with the mandatory posting requirements:

- Q005: Occupational Health and Safety Act & Construction Regulations
- P029: Health and Safety Representative Poster
- P041: JHSC/WTC Poster
- P103: Emergency Response Poster
- P022/P093: Danger signs
- S103: First Aid Kit Inspection Card

In addition, visit the **Policy and Procedures** section of our website for free downloadable samples and templates for the following:

- Company Health and Safety Policy and Procedures
- Emergency Response Plan
- Fall Arrest Rescue Procedures
- Workplace Violence and Harassment Policy



2 Job Safety Analysis

Before the projects starts, make sure that your company's health and safety policy and program includes development of job safety analyses that reflect the jobs your workers will do on a worksite.

A job safety analysis (JSA), also called a job hazard analysis or job task analysis, is a systematic analysis of work steps in a specific location that identifies the hazards and determines the controls.

By completing a JSA, you ensure that you have planned the work properly and that workers can do it safely. As a written document, it can serve as evidence of due diligence.

To be effective, the JSA must cover all aspects of a specific task. Most projects require several JSAs, and that isn't surprising when you consider the number of different tasks being done at the same time.

JSAs not only help prevent workers from getting injured, but they also help prevent damage to equipment and the environment. By doing this, JSAs help keep work on schedule.

Creating a JSA

JSAs should be written by a **competent person** because, as defined by the OHSA, that person knows what the hazards are on the jobsite. Usually that person is the foreperson or supervisor.

If creating a JSA, this is the procedure to follow.

1. **Write down the job steps.**

   The first step is to identify the task, usually a situation that is repeated on many jobsites. For example, accessing a roof top or working near the roof edge.

   Once you have a clear understanding of what the work involves, you need to break it down into manageable steps. These steps are not only specific to the job, but also specific to the work area. If the work area changes, the steps may need to change as well.

   If the steps are too detailed, the JSA will be burdensome and difficult to follow. If they are not detailed enough, you may miss some hazards.

2. **Identify the hazards associated with each step.**

   This is the most challenging part of the JSA. Take each step and list the hazards associated with it. Think about what could go wrong from a health and safety point of view. Think about how people, equipment, materials, and the surrounding environment contribute to a hazard.

   To help identify potential hazards, consider the following:

   - causes of past injuries
   - other work going on near the work area
   - legislation or regulatory requirements
   - manufacturer's instructions for equipment.

   Keep in mind that if your workers do the same job in two different locations, you may need two JSAs because the surrounding hazards may be different.

3. **Determine controls for each hazard.**

   Each hazard you identified in the previous step needs a control. The control explains how you will eliminate the hazard or significantly reduce the risk of injury.

   Use a chart like in the JSA form provided on page 2-3 to show the job steps, hazards, and controls. As a reference, refer to page 2-2 for a sample JSA on setting up an extension ladder.

4. **Discuss the JSA with your workers.**

   Once you have completed the first three steps, you should have a well-developed JSA. Now, it's time to share it with your workers. The JSA won't be effective if workers don't know about it and understand it. The information on a JSA should be communicated to workers in a language they understand.

   Before starting work, review the relevant JSA with your crew and make sure everyone knows how they are supposed to do the job. If you're dealing with a task that will last more than one day, it's a good idea to review the JSA each morning before work starts.

5. **Keep the JSA up-to-date.**

   We know how often work plans change. When. things change, the supervisor or foreperson must update the JSA to include any new hazards, and then review the JSA again with all workers.

Sample Job Safety Analysis

The following is a sample JSA for setting up an extension ladder.

Job Steps	Hazards	Barriers or Controls
Lift ladder off truck from braces.	Strain and sprain	Use mechanical leverage to raise ladder from truck bracket, or mount in an easily accessible location.
		Lift one end at a time.
		Get assistance from another worker.
		While maintaining balance, carry ladder with feet toward the front so it's ready to set up.
Carry and set up ladder.	Strain and sprain	Lift ladder onto shoulder directly from truck bracket. Consider using a shoulder pad to prevent contact stress at the shoulder
		Ensure good grip before walking.
		Get assistance from second worker for large ladders.
		Bend knees if setting ladder on ground.
		Set ladder feet on ground and walk towards wall raising ladder against wall. Practice this step with small ladders.
	Fall	Adjust ladder footing as required and, where applicable, secure bracing/stabilizers in place
		Ensure ladder is not leaning, is on firm ground, and is secured at the top to prevent movement.
	Slip and trip	Ensure your path of travel is clear before removing ladder from truck bracket.
		Know where obstacles are before travelling with ladder.
		Make sure you have a clear set-down area.
	Electrocution	Check for overhead wires before setting up ladder.
Next steps... **(Climb ladder, etc.)**		

Prepared By _____

Approved By _____ Date Approved _____

Before using the ladder, complete a **Ladder Risk Assessment Checklist** (see page 2-4) and make sure it aligns with IHSA's "Ladder Use in Construction Guideline" (ihsa.ca/News-Events).

JSA No. _____

Job Safety Analysis Form

Company Name _____ Project _____

Contractor _____ Supervisor in Charge _____

Work Location _____ Estimated Start Date/Duration _____

Work Description _____

Trade Groups (including sub-contractors) _____

Major Equipment _____

Reference Material _____

Job Steps	Hazards	Barriers or Controls

Prepared By _____

Approved By _____ Date Approved _____

Instructions:

1. To be prepared by the supervisor most directly involved in the work.
2. Must be approved by preparer's management supervisor.
3. Must be reviewed by all workers involved in the work.
4. Emergency plan must be considered.
5. If the work plan changes and the JSA is amended, changes must be reviewed by all workers involved in the work.

Sample Ladder Risk Assessment Checklist

Company:	Date:
Completed by:	Site:

In all situations, ladder use is subject to the following safe work practices. Ensure that these items have been addressed.

Safe Work Practices	In Progress	Date Completed
The ladder has been visually inspected.	☐	
The ladder is the appropriate CSA grade (Grade 1 or 1A for construction use) and has been rated for the amount of weight it will be required to support.	☐	
Workers have received training on safe ladder use and appropriate fall protection.	☐	
Workers have received instruction on the JSA associated with this checklist.	☐	
Alternatives (to a ladder) have been considered (e.g., fixed-access ladder, PEWP, scaffold, etc.), and a ladder is deemed most suitable for the task.	☐	
The selected ladder type (step, extension, platform, etc.) is suitable for the task.	☐	
The ergonomics of maneuvering the ladder have been assessed and addressed.	☐	
The ladder is secured from movement: • It has a firm level base that is secured where possible. • It is tied at the top to an available structure.	☐	
Material and/or tools can be raised or lowered by using a tool belt or rope in order to keep hands free.	☐	
Three-point contact can be maintained while climbing.	☐	
Ice and snow at the base and top is clear or will not affect the ladder stability or the worker's footing.	☐	
Traffic in the area of the base and top is controlled.	☐	
Enough space is left at the base for proper ladder angle.	☐	

Approved By _____ Date Approved _____

3 Emergency Preparedness

An emergency is an unplanned event that has the potential to:

- harm the life, health, or safety of a person
- damage public property
- damage the environment.

Emergency Response Plan

Every project needs an emergency response plan before work begins. If something goes wrong, it is important that everyone be prepared.

The purpose of an emergency response plan is to ensure that emergency procedures are in place and every worker is prepared to respond to any emergency in a correct, timely, consistent, and dependable manner.

A quick and efficient response to an emergency will:

- prevent the present situation from getting worse
- protect workers and the public from further danger and injury
- provide first aid to injured workers
- protect material and equipment from further damage
- isolate and secure the area to ensure that nothing is disturbed.

Always ensure the workers on a site are familiar with existing site policies and procedures before starting work. These procedures will guide the response to any emergency situation that arises on the worksite.

Know the law

Ontario's construction regulation (O. Reg. 213/91) requires the following:

- The constructor must establish written procedures to be followed in the event of an emergency at the project. (s.17(1))
- The constructor must post the procedures in a conspicuous place at the project. (s.17(3))
- Every worker at the project must have access to a means of two-way communication in the event of an emergency. (s.18).

An effective plan must include the following:

1. Hazard Identification/Assessment

Identify hazards and assess potential risk by answering the questions: What can go wrong? What are the consequences?

2. Emergency Resources

Determine the resources available for the hazards identified. Verify that 911 operates in area. If not, make alternate arrangements.

Maintain on-site resources such as fire extinguishers, spills containment equipment, and first aid kits. Outside help may be so far away that on-site resources are necessary, such as fire protection or ambulance/medical resources in remote areas.

3. Communication Systems

To relay accurate information quickly, reliable communications equipment must be used, procedures developed, and personnel trained. A backup system is a good idea in case the emergency destroys phone lines, for instance.

The type and location of emergency communication systems must be posted on the project. Emergency phone numbers and the site address/location should be posted beside all site phones. The *Emergency Response Poster* (P103), available from IHSA, can be used to record this and other information.

4. Administration of the Plan

The person in charge of administering and organizing the plan must ensure that

- everyone clearly understands their roles and responsibilities within the plan
- adequate emergency resources are kept in step with the progress of the project
- the plan is reviewed regularly and always after an emergency to correct any shortcomings.

5. Emergency Response Procedure

The Emergency Procedures chart (on right) outlines standard emergency response procedures. STOP and ASSESS the situation before performing any of the tasks. Stay calm to provide an example to others.

6. Communication of the Procedure

- Review with subcontractors, workers, and suppliers to ensure that it covers their activities.
- Review with owner/client in operating plants to ensure that hazards are identified and covered.
- Review with JHSC or health and safety rep on a regular basis to address new hazards or significant changes in site conditions.
- Post the procedure in a conspicuous location.

When developing your plan, make sure it always reflects current conditions on the jobsite. For more detailed information on developing emergency response plans, refer to the **Emergency Response Planning Checklist** at the end of this chapter.

Post the Emergency Response Plan in a Conspicuous Location

Emergency Procedures

1		**STAY CALM** DO NOT PANIC. Your behaviour can influence others so staying calm will help the emergency response.
2		**TAKE COMMAND** Call—or delegate someone to call—emergency services (911) immediately and explain the situation. Assign someone to meet and direct the ambulance to the location.
3		**ASSESS THE SITUATION** Use extreme caution when approaching the scene to avoid being injured yourself. Try to determine what happened and what the emergency is. Try to eliminate or control the cause of the emergency to prevent further danger to the injured worker, to others, or to the property. Give first aid as soon as possible.
4		**PROVIDE PROTECTION** Safeguard the area to protect others from being injured and prevent further losses. You may be called upon to help divert traffic, suppress a fire, prevent objects from falling, or shut down equipment or utilities.
5		**PRESERVE THE SCENE** Do not disturb anything except to save a life, relieve suffering, or prevent immediate or further losses. Barricade, rope off, or post a guard at the scene to make sure that nothing is moved until the authorities have completed their investigation.
6		**FOLLOW PROCEDURES** Follow the procedures outlined in your company's emergency response plan. Ensure that senior management is informed. They can contact the proper authorities, notify relatives, and begin the procedures for reporting and investigating the incident.

For additional resources, visit the Emergency Preparedness web page in the **Policy and Program Templates** section of the ihsa.ca website:

ihsa.ca/resources/emergency_preparedness.aspx

REMEMBER: Calling 911 by itself is not an emergency response plan. A plan should involve reducing the risk of further injuries and taking into consideration such things as:

- Proper access for emergency responders and vehicles
- The need to move a worker, if necessary, to a place where they can be attended to by emergency responders
- Designating a person to be in charge of the situation during an emergency.

Working at Heights Rescue Procedures

If a worker is involved in a fall that has been arrested, it is important to get them to a safe place as quickly as possible without causing further injury or putting the rescuers at risk.

The Construction Projects regulation (O. Reg. 213/91, s.26.1(4)) requires that before workers use any fall arrest system or safety net on a project, the employer must develop written procedures for the rescue of a worker whose fall has been arrested.

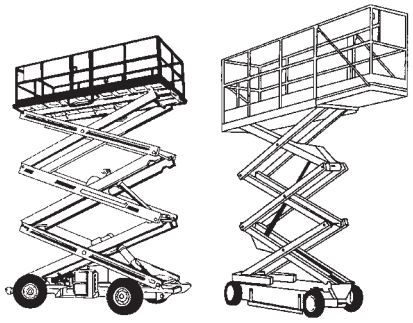
Some of the reasons why a suspended worker should be rescued quickly are listed below

- The worker may have been injured during the fall and may need medical attention.
- The worker may panic if they are left hanging for a long time.
- The event that led to the fall may have created additional dangers that need to be dealt with right away.
- The worker may develop suspension trauma if they are hanging in a safety harness for too long. Suspension trauma causes the blood to pool in the lower body, depriving the brain of oxygen.

In many cases, the rescue plan can be simple. A ladder or elevated work platform can be used to reach suspended workers and get them down safely.

In other cases, it makes more sense to haul the worker back up to the level from which they fell or pull the worker in through a nearby window or other opening.

For some projects, the rescue procedures may be more complicated. You may need specially trained and equipped rescue workers from the local fire department. Aerial ladder trucks or other high-reach equipment may be necessary. In extreme cases, the fire department may use rappelling techniques to reach trapped workers and lift or lower them to a safe place.



High-reach Equipment (e.g., EWPs) May Be Needed for Rescue

Create a rescue plan that is specific to your jobsite and that covers the different types of fall-related rescues that may be necessary. The plan should cover the on-site equipment that you will use, the personnel who will use it, and the procedures for different types of rescue.

Any off-site rescue services that might be needed should be contacted in advance to make sure that they have the proper resources available (equipment, specially trained personnel, etc). The constructor should make arrangements to familiarize rescue services with the project and any hazards that they may encounter.

Once the written rescue plan has been developed, make sure everyone on the site is familiar with it. That's especially important for any worker who will be using fall protection equipment.

NOTE: There are differences in equipment from different manufacturers as well as from different product lines in the same company. Therefore emergency training must cover the *same* harness, lanyard, energy absorber, rope grab, lifeline, and anchorage that each worker will rely on, as well as the ways in which each will be used.

Sample Fall Rescue Procedures

Here are some examples of general fall rescue procedures that your plan should include.

A. If an elevating work platform (EWP) is available on site:

1. Take it to the location of the suspended worker.
2. Make sure that rescue workers using the EWP are protected against falling.
3. Be sure the EWP has the load capacity for both the rescuer(s) and the victim.
4. Use the EWP to reach the suspended worker.
5. Position the EWP platform below the worker.
6. Disconnect the suspended worker from their lanyard or lifeline when it is safe to do so. If the worker is unconscious or can't help with the rescue, two rescuers may be needed to handle the worker safely.
7. Treat the worker for suspension trauma and any other injuries.
8. Arrange to take the worker to the nearest hospital.

B. If an elevating work platform is not available:

1. Where possible, use a ladder (or ladders) to reach the suspended worker.
2. If the suspended worker is not in an area that rescuers can reach by ladders, move the suspended worker by their lifeline to an area that can be safely reached by ladder (if possible).
3. Rig a separate lifeline for each rescuer to use while carrying out the rescue.
4. Position the ladder(s) so that the rescuers can get beneath the suspended worker.
5. Securely attach a separate lowering line to the suspended worker's harness.
6. Rescuers on the ground will lower the worker while the rescuers on the ladders will guide the worker. If the suspended worker is unconscious or can't help with their own rescue, two rescuers may be needed to handle the worker.
7. Once the worker has been taken to a safe location, administer first aid for suspension trauma and any other injuries.
8. Arrange to take the worker to the nearest hospital.

C. If the injured person is suspended near the work area and can be reached safely from the floor below or from the place from which the worker fell:

1. Make sure that all rescuers are protected against falling (such as by travel restraint or fall arrest).
2. If possible, attach a second line securely to the worker's harness to help pull him or her to a safe place. At least two strong workers will probably be needed to pull someone up.
3. Eliminate slack in the retrieving line to avoid slippage.
4. Once the worker has been taken to a safe place, administer first aid for suspension trauma and any other injuries.
5. Arrange to take the worker to the nearest hospital.

D. If a person has fallen and is suspended in an inaccessible place (e.g., on a tower, against a building, or in a structure that has no openings):

1. You may need trained personnel and specialized rescue techniques to rescue the worker. For example, the rescuer may have to lower themself down to the suspended worker or use a lifeline to retrieve them.
2. Because of the inherent risk in this type of rescue, only people with specialized training should do it.

Emergency Rescue in Challenging Situations

Certain circumstances on a jobsite can present a challenge for rescue personnel who may need to remove an unconcious or immobile worker from an area that is difficult to get to or hard to find. Refer to the Emergency Procedures chapter in IHSA's *Construction Health and Safety Manual* (M029 2019 ed.) for additional sample rescue procedures.

Emergency Response Planning Checklist

Use the checklist on the next page as a guide to help you develop the emergency response plan for your workplace. Remember that the plan must be specific to the location where you are working.

When the plan is complete, make sure that everyone involved knows their role.

Emergency Response Planning Checklist

Company:	Date:
Completed by:	Site:
Program Administration: (Who's responsible for implementing the plan?)	

	In Progress	Date Completed
Develop an Emergency Response Standard.	☐	
Develop a Site Emergency Plan.	☐	
• Identify emergency access routes.	☐	
• Indicate location of first aid stations/boxes and fire extinguishers.	☐	
• Indicate job office(s) and storage facilities (storage for blankets and special rescue equipment).	☐	
• Ensure specialized PPE equipment is on site. (Indicate location.)	☐	
• Ensure sufficient medical aid supplies are available on site (splints, stretchers, etc.) and indicate location.	☐	
• Locate other firefighting equipment (standpipes, Siamese connections, and hydrants).	☐	
• Locate main power supply to the project.	☐	
• Identify the location of emergency phones. (Post emergency list.)	☐	
• Identify nearest hospital or medical centre.	☐	
• Identify worker evacuation route(s) and assembly area(s).	☐	
• Contact local fire, police, and ambulance and provide them with your site plan and list of potential emergencies.	☐	
• Locate services to the project (both above ground and underground).	☐	
• Develop on-site traffic routes.	☐	
• Locate outside materials storage and fabricating areas.	☐	

Emergency Response Planning Checklist (continued)

	In Progress	Date Completed
• Locate cranes man/material hoists and unloading docks.	☐	
• Locate flammable/combustible materials and cylinder storage.	☐	
• Locate garbage dumpsters and recycling bins.	☐	
• Complete **Hazard Identification and Risk Assessment Form***	☐	
• Determine if "high-level" rescue is a possibility.	☐	
• Develop Emergency Response procedures for items identified in your hazard assessment.	☐	
• Ensure that all trades on site keep daily personnel lists. (In the event of a major emergency, check names against personnel gathered in the assembly area.)	☐	
• Include requirements for written notices. (What's required? When? Completed by whom? Who does it go to?) See legal obligations.	☐	
• Identify the emergency response (ER) team and alternates. (Post names.)	☐	
• Provide specialized training for ER team members.	☐	
• Designate a contact person to call necessary emergency services and MOL, MOEE, etc.	☐	
• Select member of ER team to meet and direct emergency services vehicles to incident scene.	☐	
• Select team member to deal with media, MOL, MOEE, etc.	☐	
• Ensure all required rescue equipment/materials are readily available on site.	☐	
• Provide for emergency traffic control person (properly trained).	☐	
• Make provisions for cordoning off the accident scene to protect workers.	☐	
• Ensure someone on the ER team documents where the injured worker has been taken (hospital, medical centre, etc.).	☐	
• Set out method of communicating the plan.	☐	

*This form can be downloaded from: ihsa.ca/resources/hazard_assessment_analysis_control.aspx

The entire checklist can be downloaded from: ihsa.ca/resources/emergency_preparedness.aspx

4 Occupational Health Hazards

Roofers are exposed to many chemical and physical hazards. Besides WHMIS-classified material, dangerous substances may come from many sources.

Occupational health hazards in roofing include cold weather in the winter, heat in the summer, and ultraviolet radiation from the sun. This section describes some of the occupational health hazards encountered by roofers and ways in which they can be avoided or minimized.

Histoplasmosis

Histoplasmosis is a fungal disease that infects the lungs. It can be very serious if left untreated. The fungus grows in places where there are bat or bird droppings. When the fungus reproduces, it releases tiny bodies called spores. When the spores are disturbed, they become airborne and can be breathed into the lungs, where they may start an infection.

The disease cannot be transmitted from one infected person to another.

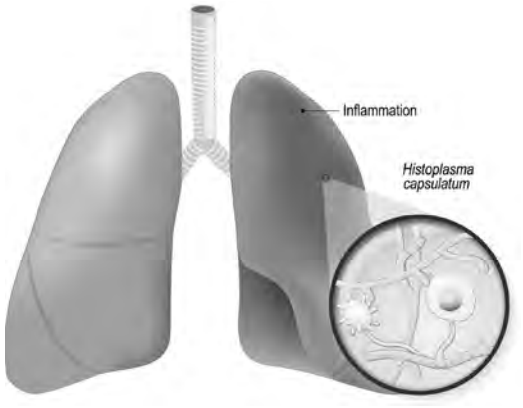
Health effects

The symptoms of infection range from non-existent to severe. If symptoms do appear, they generally start, on average, 10 days after exposure. Symptoms may include

- fever
- chest pains
- dry cough
- general feeling of being unwell
- infection of other parts of the body if not treated
- death if not treated.

Precautions

- Avoid places that may harbour the fungus (e.g., accumulations of bird or bat droppings).
- Before starting a job or activity that poses a risk of histoplasmosis infection, consult the NIOSH/NCID information sheet called *Histoplasmosis: Protecting Workers at Risk.* This publication contains information on work practices and personal protective equipment that will reduce the risk of infection.



Histoplasmosis Can Affect the Lungs

Legionella

Legionella is a dangerous bacterium that thrives in stagnant water, such as groundwater lakes, rivers, ponds and man-made water systems. The main sources of exposure to contaminated water are:

- cooling towers
- evaporative condensers
- water-spray humidifiers
- hot water storage tanks.

However, anything that creates mist should be considered a possible source.

Health effects

Breathing in the mist created by these systems can cause serious infection if legionella is present. Legionella bacteria mainly cause two different diseases: Legionnaires' disease and Pontiac fever.

By far the more severe of those diseases is Legionnaires' disease. It usually develops two to ten days after exposure. The symptoms include:

- cough
- fever and chills
- diarrhea
- confusion
- pneumonia and organ failure in severe cases.

Legionella bacteria are not transmitted from one person to another, and you do not get sick from drinking contaminated water.

Pontiac fever is a mild flu-like illness that develops one to three days after exposure. Recovery usually takes place within two to five days without medical treatment. A healthy person exposed to legionella bacteria is far more likely to develop Pontiac fever than Legionnaires' disease.

Precautions

Take the following precautions when you are working in infected "hot zones" or near cooling towers, humidification systems, hot water tanks, or similar equipment:

- Find out if the water system is maintained in compliance with one of the two standards for controlling legionella (ASHRAE or CTI).
- Avoid stagnant water that has a film on it.
- Do not disturb stagnant water.
- Wash your hands with soap and water, or use an anti-bacterial hand sanitizer before eating, drinking, smoking, or leaving the worksite.
- Use personal protective equipment such as
  - leather gloves when handling equipment
  - rubberized gloves when using biocides or bleach
  - a NIOSH-approved N-100 full-facepiece respirator if there are suspected cases of Legionnaires' disease or if the system could have significant contamination
  - a NIOSH-approved N-95 respirator if there is a possibility of exposure.

  Exposure is possible if the water system hasn't been maintained, if there is stagnant water around that will be disturbed, or if indoor air-quality problems have been reported. (A NIOSH N-95 respirator is optional if the water system is maintained and there is no water or misting of water.)

A Respirator Can Prevent Exposure to Legionella Bacteria

West Nile Virus

Those who work outdoors in the summer and early autumn can contract West Nile virus, which is transmitted by the bite of an infected mosquito. Even if infected, however, most people (about 80%) don't show any sign of illness.

Health effects

Common symptoms of West Nile virus include:

- Headache
- Fever
- Body ache
- Nausea
- Rash on chest, stomach, or back.

Approximately one in 150 people will have serious symptoms including brain damage, which may be fatal in severe cases. If you think you may have contracted West Nile virus, contact your doctor immediately.

Precautions

- Stay indoors when your work allows it.
- Wear loose, light-coloured protective clothing, which includes a long-sleeved shirt, long pants, and socks.
- Use an insect repellent containing DEET or Picaridin on the skin and on the outside of thin clothing. Do not spray insect repellent on skin that is under your clothing.

- After working, use soap and water to wash the insect repellant off your skin and any clothing that has been treated with the repellent.
- Be extra cautious when mosquitoes are most plentiful—from early evening to early morning.
- Reduce or eliminate mosquito breeding grounds (stagnant or standing water).

Asphalt

Asphalt is a complex mixture of chemicals derived from the petroleum refining process. When asphalt is heated, it releases vapours and fumes. These can be inhaled by roofers during hot asphalt applications. Asphalt fumes can also enter the body through the eyes or skin.

Health effects

The health effects of exposure to asphalt fumes include:

- irritation of the eye
- irritation of the nose and throat
- coughing or wheezing
- shortness of breath
- bronchitis
- skin irritation and rashes.

Precautions

- Prevent skin exposure by using disposable coveralls and leather-palmed gloves with cotton-backed knit wrists.
- Work upwind from the asphalt so that the fumes will blow away from you.
- Shower or wash up after work and wash your hands before eating and smoking.
- Eat lunch in a clean place away from asphalt fumes.
- Refer to the safety data sheet (SDS) for the product to get information about respiratory protection.

Cover Skin and Wear Gloves When Working with Asphalt

Coal Tar Pitch

Coal tar pitch is a black or brown, thick, sticky liquid that is extremely resistant to the elements. It was used extensively in flat and low-sloped roofing until the late 1970s. Removing old coal tar roofing systems can produce dangerous dusts.

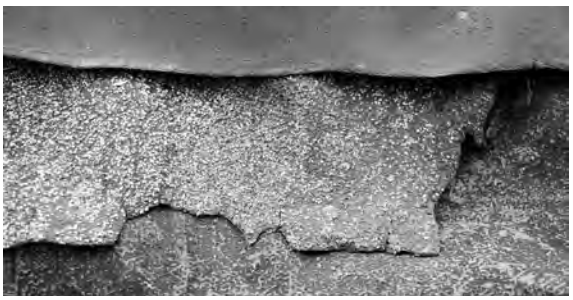
Health effects

Exposure can occur by contact with the skin or by inhalation. Skin contact with coal tar pitch and exposure to sunlight may cause an enhanced sunburn reaction called “phototoxicity.” Studies have shown that long-term exposure may also cause skin cancer.

Other studies show that inhaling dust from coal tar pitch may cause DNA damage. Coal tar pitch also has serious effects on the eyes.

Precautions

- If possible, identify any unknown roofing materials before tear-off begins. Some old roofing felts may contain asbestos.
- Spray the part of the roof being removed with a fine mist, fog, or spray before removal.
- Work upwind so dust and fumes are blown away from you.
- Protect your eyes by using CSA/ANSI-approved safety glasses with side shields.
- Wear disposable coveralls to protect your skin. Use protective creams and sunscreen on exposed skin, such as the face.
- Wash up or shower after work.
- If clothes are contaminated, wash them separately from other laundry.
- Wash hands before eating, drinking, or smoking
- Use respiratory protection to protect against dust or fumes. For the right kind of respirator, consult the supplier or refer to the SDS for the product.



Check Old Roofing Materials Before Work Begins

Lightweight Concrete

When lightweight concrete is being mixed and the bags containing the components are broken open, dust is created. In addition, some of the chemicals in lightweight concrete can harm the skin in various ways.

Health effects

The following health effects can be caused by some of the chemicals in lightweight concrete. When evaluating the risk to health, consider how much of a particular chemical is in the concrete.

Inhalation

- Respiratory tract irritation from Portland cement may cause coughing, difficulty breathing, choking, etc.
- Allergic reaction to hexavalent chromium can cause asthma-like symptoms such as wheezing and shortness of breath.
- Silicosis can result from repeated and prolonged exposure to silica.
- Some studies indicate a link between lung cancer and exposure to silica.

Cement burns

Cement burns are caused by calcium oxide in Portland cement that becomes caustic when in contact with water or sweat on the skin. This can cause cement burns to exposed parts of the skin resulting in blisters, and dead and hardened skin that sometimes turns black or green.

WARNING: Cement burns can be painless until you take off your boots or gloves at the end of the day.

Protect Against Chemical Burns and Inhalation When Working with Concrete

Allergic contact dermatitis

Allergic contact dermatitis (ACD) can be caused by skin exposure to hexavalent chromium and nickel. Once you have become sensitized, even the smallest amount can lead to strong allergic reactions such as swelling and red, itchy rashes that become crusty.

Sensitization can occur after a single exposure, after repeated exposure over months or years, or never at all.

Irritant contact dermatitis

Irritant contact dermatitis (ICD) can be caused by contact with wet Portland cement. The caustic, abrasive, and drying properties of Portland cement can lead to cracked, dry, and broken skin.

Precautions

Protecting skin and eyes

- Wear long sleeves and alkali-resistant gloves.
- Wear waterproof boots for standing in cement. If there is a risk of cement entering the boots, tape the boots to the pants.
- If kneeling on fresh concrete, use a dry board or waterproof kneepads.
- Remove jewellery such as rings and watches since cement can collect under them.
- Wash your hands, face, and exposed parts of your skin at the end of the job or before eating, drinking, smoking, or using the toilet.
- If wet cement gets on your clothing, remove clothing right away and wash away the cement from your skin. Remember: Calcium oxide in cement can cause burns when in contact with water or sweat on the skin.
- Wear safety glasses with side shields when mixing or pouring.
- Under extremely dusty conditions, use unvented or indirectly vented goggles.
- Do not wear contact lenses.

Preventing inhalation

- For short-term use, an N95 filtering facepiece respirator may be enough. Usually, however, you need a minimum of a P100 half-facepiece elastomeric respirator.
- The mixing should be done in a place where the dust and fumes will be blown away from workers.
- When opening and pouring bags, avoid creating unnecessary dust.

Hygiene

Workers on construction sites are often exposed to infectious diseases because of unsanitary conditions in and around toilets and clean-up facilities. Having a well-maintained hand-washing facility not only helps eliminate infectious diseases but also keeps roofers safe from some of the toxic dusts and chemicals they often encounter.

Hand washing helps remove toxic materials from the skin, which prevents workers from ingesting hazardous chemicals and developing skin reactions. Roofers should remember to wash their hands:

- after using the toilet
- before eating, drinking, handling food, or smoking
- after coughing or blowing their nose
- after contact with chemical agents.

Even if hand sanitizer is provided, workers still need soap and water to remove dirt and hazardous chemicals from their skin.

Constructors are legally required to provide toilets, urinals, and clean-up facilities for workers before work starts (O. Reg. 213/91, s.29). There must also be reasonable access to these facilities.

Suppliers must provide toilets and clean-up facilities that are in good condition (OHSA, s. 31). The facilities must comply with section 29.1 of the construction regulation.

Washroom Facilities Must Be Clean and Sanitary

Preventing Hygiene Hazards

- Toilets can be either water-flush toilets that are connected to a sanitary sewer or chemical flush toilets.
- Never stand under a portable toilet as it is being hoisted in place.
- There is a specified minimum number of toilets or urinals based on the number of workers on the site.
- Unless the facilities are used by one worker at a time, female workers will need separate facilities.
- Clean-up facilities should have hot and cold running water where reasonably possible and either paper towels (with a waste receptacle) or a hand dryer.
- If running water is not possible, a hand cleanser with either paper towels (and a waste receptacle) or a hand dryer is acceptable.
- There should be an adequate number of wash basins (no fewer than half the number of toilets).
- Facilities should be well-lit, heated (if possible), ventilated, and kept in good condition at all times.
- Facilities should be regularly serviced, cleaned, and sanitized and records should be kept showing when this was done.
- Workers should report any unsanitary conditions to their supervisor.

Impairment

Impairment is a state of reduced physical or mental ability. We often think of impairment as a result of using substances such as alcohol or drugs—whether they are over-the-counter, prescription, or illicit. However, impairment can result from other things such as:

- Family or relationship problems
- Fatigue (mental or physical)
- Traumatic shock
- Medical conditions or treatments.

Workers who are impaired may overlook safe work practices and create hazards for themselves and others. This is why impairment in the workplace must be managed as a potential workplace hazard.

Preventing Impairment Hazards

The most important way to reduce the impact of impairment on the workplace is to have a proper policy and response procedure in place. The policy must include clear guidance on how to handle known or suspected impairment at work.

This policy and response procedure should cover what to do in any situation, regardless of the cause of impairment. It should be communicated to all workers and enforced.

If your company does not have an impairment policy in place, download a sample one from ihsa (See *IHSA.ca Magazine*, Volume 18, Issue 2).

Signs of impairment can vary based on the individual and the type of impairment. Signs of impairment from fatigue, stress, medical conditions, or relationship problems can include changes in appearance, performance, and behaviour.

Signs of substance use can include:

- The odour of alcohol or drugs
- Glassy or red eyes
- Poor coordination
- Slurring words.

If you become aware of a worker who is showing signs of impairment, it is very important to take action immediately:

- Notify a supervisor who can speak to the worker in a private area to discuss their behaviour. Another supervisor or designated person should be present as a witness.
- Call for first aid or emergency medical assistance, if necessary.
- If necessary, call a taxi or have the employee escorted home. Do not allow them to drive themselves if you suspect impairment.

If a worker feels that they themselves are impaired, they should immediately notify a supervisor or designated person, who will assist them confidentially.

A Supervisor Should Speak with an Impaired Worker in Private

Safe Work Practices

- Do not work around impaired workers.
- Beware of the effects of medication on your ability to work safely. Consult your physician.
- Do not use illicit drugs or alcohol on the jobsite at any time.
- Talk to your supervisor if you feel unwell. Assistance may be available from your workplace or labour representative.

For more information, visit **ihsa.ca/products** and order or download *Dangerous Decisions: The Real Costs of Substance Abuse in the Workplace* (IHSA048).

5 Heat Stress

The human body functions best within a narrow range of temperatures: 36°C to 38°C (96.8°F to 100.4°F). When you do heavy work in a hot environment—indoors or outdoors—your body heat rises. To get rid of this excess heat, your body uses two cooling mechanisms:

1. Your heart rate increases to move blood—and heat—away from your internal organs and toward your skin.
2. Sweating increases to help cool your skin, blood, and body through evaporation.

When you become dehydrated, your body's cooling system can't keep up with the heat, and your temperature rises above 38°C (100.4°F). This can lead to:

- Heat rash (plugged sweat glands)
- Heat cramps (due to loss of salt caused by sweating)
- Heat exhaustion
- Heat stroke.

For more information on heat stress, refer to the Heat Stress chapter in IHSA's *Construction Health and Safety Manual* (M029) or visit the **Heat Stress** topic page at:
ihsa.ca/topics_hazards.aspx

Heat Exhaustion

Heat exhaustion occurs when your body cannot keep blood flowing both to vital organs and to the skin for cooling.

Keep Hydrated to Prevent Heat Stress

Symptoms

- Weakness
- Feeling faint
- Headache
- Breathlessness
- Nausea or vomiting
- Difficulty continuing work.

Treatment

Without prompt treatment, heat exhaustion can lead to heat stroke. Get medical aid and cool down (move to a shaded spot, loosen your clothing, and drink cool water). It takes at least 30 minutes to cool down the body after heat exhaustion.

Heat Stroke

Heat stroke is a medical emergency—you can die from it. Your body has used up all its water and salt and cannot cool itself. Your temperature rises to dangerous levels. Heat stroke is also called sunstroke.

Symptoms

- Confusion and irrational behaviour
- Convulsions
- Loss of consciousness
- Lack of sweating
- Hot, dry skin
- Abnormally high body temperature—40°c (104ºf) or more.

Treatment

If a co-worker shows symptoms of heat stroke, you should act fast.

- Call the local emergency number or get the worker to hospital.
- Take aggressive steps to cool the worker down. Examples include the following:
  - Immerse in a tub of cool water.
  - Place in a cool shower.
  - Spray with a hose.
  - Wrap in a cool, wet sheet and fan rapidly.
- Do not give an unconscious worker anything to drink.

Preventing Heat Stress

- Wear light, loose clothing that allows sweat to evaporate.
- Wear light-coloured clothing because it absorbs less heat from the sun.
- Drink one cup of cool water (8 ounces) every 20 minutes, even if you're not thirsty.
- Avoid alcohol and caffeinated drinks (e.g., coffee, tea, cola), which can make you urinate more frequently.
- Avoid eating hot, heavy food. It can raise your body temperature by redirecting blood to your digestive system.

Your physical condition can increase your risk of developing a heat-related illness. Age, weight, fitness level, health conditions (heart disease or high blood pressure), recent illnesses, previous heat-related illnesses, or medications can all reduce your ability to deal with the heat.

Drink a Cup of Cool Water Every 20 Minutes

For more information about heat stress, refer to IHSA's *Construction Health and Safety Manual* (M029) or visit the **Heat Stress** topic page:
ihsa.ca/topics_hazards/heat_stress.aspx

6 Cold Stress

Cold stress or **hypothermia** can affect workers who are not protected against cold. The cold may occur naturally (e.g., from weather conditions) or be created artificially (e.g., from refrigerated environments).

Cold is a physical hazard in many workplaces. When the body is unable to warm itself, serious cold-related illnesses may occur, leading to permanent tissue damage and even death.

Workplaces exposed to cold, wet, and/or windy conditions include:

- Roofs
- Large steel structures that retain cold or are exposed to cold
- High buildings that are open to the wind.

Exposure to cold causes two major health problems:

1. Hypothermia

2. Frostbite.

For more information on cold stress, refer to the Cold Stress chapter in IHSA's *Construction Health and Safety Manual* (M029) or download the safety talk on cold stress at:

ihsa.ca/resources/safetytalks.aspx

Frostbite

Frostbite is a common injury caused by exposure to severe cold or by contact with extremely cold objects. It occurs more readily from touching cold metal objects than from exposure to cold air. That's because heat is rapidly transferred from skin to metal.

When you are cold, blood vessels in your skin, arms and legs constrict, decreasing the blood flow to your extremities. This helps your vital organs stay warm, but you risk frostbite in your hands and feet.

Having frostbite means that your flesh actually freezes. Blood vessels are damaged and the reduced blood flow can lead to gangrene.

The body parts most commonly affected by frostbite are face, ears, fingers, and toes. Frostbitten skin looks waxy and feels numb. Once tissue becomes hard, it's a medical emergency.

Treatment

- Warm frostbitten area gradually with body heat. Do not rub.
- Don't thaw hands or feet unless medical aid is distant and there is no chance of refreezing. Parts are better thawed at a hospital.
- Apply sterile dressings to blisters to prevent breaking. Get medical attention.

Hypothermia

Hypothermia (also called exposure) is the condition of having an abnormally low core temperature. When the body can no longer maintain core temperature by constricting blood vessels, it shivers to increase heat production. Maximum severe shivering develops when the body temperature has fallen to 35°C (95°F).

Moderate symptoms

- Shivering
- Blue lips and fingers
- Slow breathing and heart rate
- Disorientation and confusion
- Poor coordination.

Severe symptoms

- Unconsciousness
- Slowing heartbeat to the point where pulse is irregular or hard to find
- No shivering
- No detectable breathing
- Patient appears dead.

REMEMBER: Always assume the injured person is alive.

Treatment

- Hypothermia can kill—get medical aid immediately.
- Carefully move the injured person to shelter. (**WARNING:** Sudden movement can upset the heart rhythm.)
- Keep the person awake.
- Remove wet clothing and wrap the person in warm covers.
- Apply direct body heat—warm the neck, chest, abdomen, and groin, but not the extremities.
- If conscious, give the person a warm, sweet drink.

Wind Chill

Wind chill involves the combined effect of air temperature and air movement. The wind makes your body lose heat faster. For example, when the air temperature is –30°C (–20°F), the following things can happen:

- with no wind there's little chance of skin freezing
- with 16 km/h wind (enough to fully extend a flag), your skin can freeze in about a minute
- with 32 km/h wind (enough to blow snow), your skin can freeze in 30 seconds.

Preventing Cold Stress

- Use air as an insulator by wearing several layers of clothing rather than one thick layer.
- Wear synthetic fabrics next to the skin to "wick" away the sweat.
- If conditions require, wear a waterproof or wind-resistant outer layer.
- If your clothing gets wet at 2°C or less, change into dry clothes immediately and get checked for hypothermia.
- Wear warm gloves.
- Wear a hat or hood. You may even need a balaclava.
- Do not wear tight boots or shoes—they restrict blood flow. You need enough room to wear either one thick or two thin pairs of socks.

- If you get hot while you're working, open your jacket but keep your hat and gloves on.
- Have warm, high-calorie drinks and food on hand.

The best protection against cold-related health risks is to be aware and be prepared. Workers should recognize the signs and symptoms of overexposure in themselves and others. Pain in the extremities may be the first warning sign. Any worker shivering severely should come in out of the cold.

For more information about cold stress, refer to the **Cold Stress** chapter in IHSA's *Construction Health and Safety Manual* (M029).

7 Planning and Housekeeping

Many roofing injuries are related to materials handling and housekeeping. Roofers can reduce materials-handling injuries by limiting double handling (moving it twice) and using devices that minimize manual labour.

Housekeeping injuries can be reduced by putting proper clean-up procedures in place and keeping the job free of falling and tripping hazards. But housekeeping is not limited to picking up garbage. In roofing, housekeeping also includes proper planning, setup, access, and storage.

Use Good Housekeeping Practices

Planning

- Before or upon arriving on a jobsite, decide on the set-up for access, storage space, and garbage disposal.
- Identify site hazards such as powerlines.
- Identify site limitations and restrictions, such as fire escapes or the need for the public to enter the building. NOTE: Be sure to allow adequate time to set-up and clean-up.
- Consider safety issues such as public access, propane handling and storage, kettle location, fall protection, location and type of hoist required, and fire watch.
- Monitor the weather and adjust work schedule and assignments accordingly.
- Establish first aid and emergency procedures.
- Ensure clear communication between the estimator, project manager, supervisor, general contractor, and client.
- Provide protective equipment for all workers.
- Brief workers on site health and safety policies, hazards, and emergency procedures.

Public Way Protection

You must take steps to protect the public in areas around a construction site. If work is being done on a building or structure within 4.5 m (15 ft) of a public way (e.g., a sidewalk or road), that public way must be covered.

If work on a project may endanger the public, regardless of how far it is from any public way, a sturdy fence at least 1.8 m (6 ft) high must be built between the public way and the project. For more information, see "Public Way Protection" in the construction regulation (O. Reg. 213/91, s. 64-66).

Set-up

Considerations when setting up:

- Protection of propane cylinders from traffic and sources of ignition
- Firm ground for storage and hoisting purposes
- Proper anchors or anchor points for lifelines and fall protection
- Levelling of kettles, tankers, and propane tanks
- Carrying capacity of the roof for storage and hoisting
- Location of powerlines and overhead obstructions when hoisting
- Location of rooftop heating and cooling units
- Vents and air intakes that can draw fumes into the building and vicinity
- Securing of lids and spigots on kettles when work is finished for the day
- Locking and securing of all trucks, hoists, box trailers, and equipment
- Preventing access to the roof by removing ladders and locking them up in a horizontal position at the end of the work day
- Condition of electrical cables for the heating and cooling units because of danger of electrocution if the units have to be moved. (REMEMBER: When lockout/tagout is required or when a unit must be disconnected for relocation, use a qualified electrician.)

IMPORTANT: Give workers time to practise good housekeeping techniques.

Always keep barricades and warning signs in place. If they must be removed for roofing installation, loading, or unloading, replace them as soon as the task is finished.

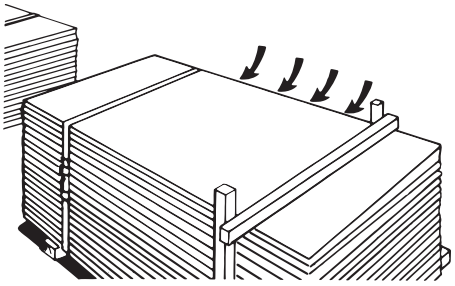
Access

- Allow proper movement for workers, material, and garbage. This includes the proper setup and maintenance of ladders.
- Ladder rungs and landing areas should be free of mud, ice and water. More than half of all ladder injuries happen at the top or bottom landing areas.
- Ensure proper setup of fall protection.
- In the winter, clear a path to the work areas.

Use Plywood to Make Moving Materials Easier

Storage

- Store material properly, away from fire hazards.
- Secure materials to prevent them from rolling or falling accidentally from building edges and floor openings.
- Keep materials at least 1.8 m (6 ft) away from roof edges or openings. Rolls of material such as asphalt felt should be banded to prevent accidental toppling and rolling.
- Secure loose material such as insulation and sheets of plywood to prevent them from blowing away in a strong wind.
- Keep storage area tidy, and store material in designated areas to reduce tripping hazards.
- If material must be stored on a roof, distribute it evenly. Make sure the weight in any one place does not exceed the roof capacity.

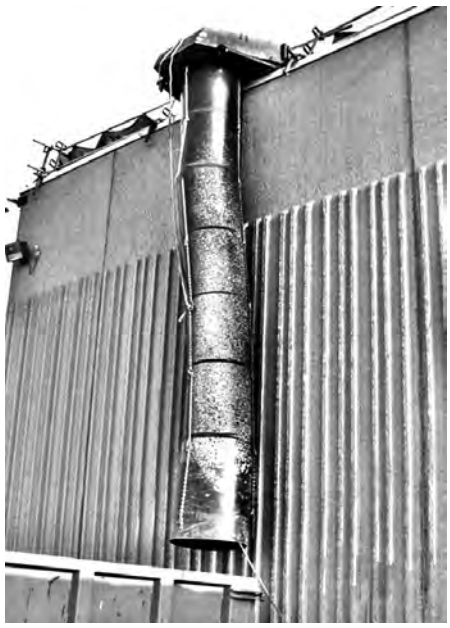


Secure Loose Material Against the Wind

Sample Site Layout for Storage and Disposal

Garbage Disposal

- Dispose of garbage immediately to remove hazards underfoot.
- Pick up as you go to keep the ground or roof free of a buildup of garbage that may hide openings and other hazards.
- Designate an area for waste disposal. Try to avoid double handling.
- Remove full waste containers and replace them with empty ones.
- Do not allow garbage to fall freely from one level to another. It should be dropped down a chute or lowered in a container or by a crane or hoist.
- When using a chute, make sure that the bin below is covered to keep dust from flying around and keep the chute free of debris.



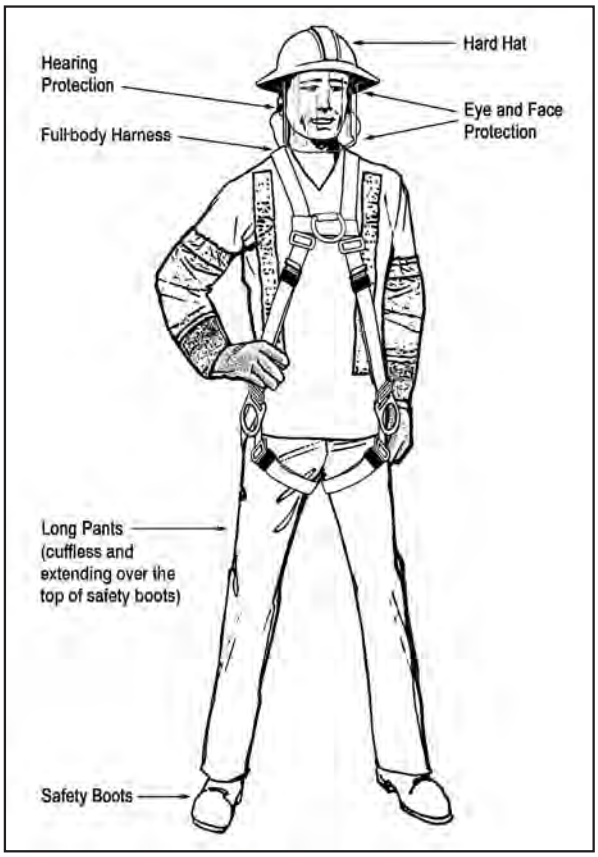
Use a Chute to Lower Garbage from Roof

8 Personal Protective Equipment

Personal protective equipment (PPE) is designed to protect workers from physical dangers and/or health hazards. Equipment such as hard hats, safety glasses, and safety boots are designed to prevent an injury or reduce the severity of an injury if one occurs. Other PPE, such as hearing and respiratory protection, is designed to prevent illnesses and damage to the worker's health.

It is important to remember that PPE only provides protection. It reduces the risk but does not eliminate the hazard. The best way of protecting workers is to control the hazard at the source or along the path. However, if that is not possible, controls need to be put in place at the worker. This concept is referred to as the "hierarchy of controls".

It is the roofer's responsibility to wear the protective equipment and clothing required by the OHSA and the Construction Projects regulation. In addition, roofers must wear any protective equipment required by the employer. This may include, but is not limited to, the clothing and equipment listed below.



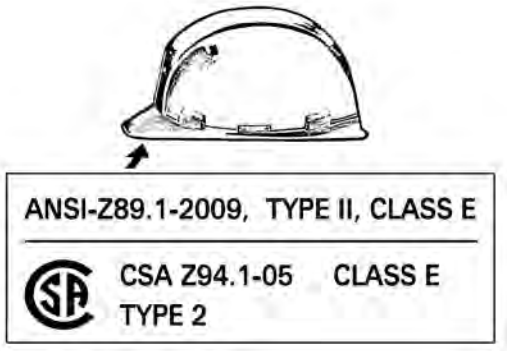
PPE for Roofers

Head Protection

Every worker must wear a hard hat at all times on a construction project in Ontario (O. Reg. 213/91, s. 22). It must protect the wearer's head against impact and against small flying or falling objects. Also, it must be able to withstand an electrical contact equal to 20,000 volts phase-to-ground.

Standards

Hard hats must meet the minimum criteria established by the Canadian Standards Association (CSA) or the American National Standards (ANSI). The "Type" and "Class" of hard hat can be identified by the CSA or ANSI label. Some manufacturers stamp the CSA or ANSI classification into the shell of the hard hat under the brim.



The hard hats listed below meet the minimum requirements for use on construction sites:

CSA

- Z94.1-05: Class E, Type 1
- Z94.1-05: Class E, Type 2
- Z94.1-1992: Class E

ANSI

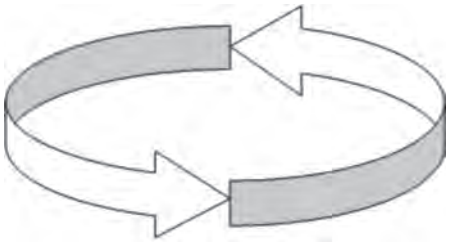
- ANSI Z89.1-2009: Class E, Type I
- ANSI Z89.1-2009: Class E, Type II
- ANSI Z89.1-2003: Class E, Type I
- ANSI Z89.1-2003: Class E, Type II

Although both Type 1 and Type 2 hard hats protect the top of the head, Type 2 hard hats provide extra protection against side impact and penetration. For that reason, Type 2 is recommended for construction work.

Roofers should consider wearing a wide-brimmed hard hat because most of their work is done out of doors. The brim helps protect the face and neck from the sun's damaging ultraviolet (UV) rays.

Wide-brimmed Hard Hat

Hard hats should normally be worn facing forward. A hard hat should be worn in reverse only if it has a reverse orientation mark and the job, task, or work environment necessitates wearing it backward (e.g., when wearing a face shield or welding helmet).



Reverse Orientation Mark

Foot Protection

When on site, roofers must wear CSA-certified Grade 1 footwear. CSA Grade 1 offers the highest level of protection and is the only one allowed in construction. In Grade 1 boots, a steel toe protects against falling objects, while a steel insole prevents punctures to the bottom of the foot.

Roofers should also wear long pants that cover the top of the boots. In case of spillage, this will prevent hot asphalt from getting into the boot and burning the feet.

Grade 1 work boots can be identified by the following markings:

- A green triangular patch containing the CSA logo on the outside of the boot
- A green label indicating Grade 1 protection on the inside of the boot.

Work boots should also provide protection against any electrical hazards on site. A white label with the Greek letter Omega in orange means that the boot protects against electric shock under dry conditions.

Ω

Eye Protection

Roofers should wear properly fitted industrial-quality safety glasses on jobsites. Since they spend a great deal of time exposed to the sun, glasses with UV protection are strongly recommended.

When drilling into concrete or masonry or working near an operating roof cutter, it's better to wear safety goggles rather than spectacles for extra protection against dust and flying particles.

Face shields, which protect against splashes, must be worn by roofers working with a kettle or tanker.

IHSA recommends that safety glasses meet the requirements of CSA Standard Z94.3-2007 Class 1. Look for the manufacturer's ID mark and the CSA logo on both the frame and the lens—they indicate industrial-quality glasses.

Kettleman's Hard Hat with Face Shield

Clothing

- On the job, do not wear:
  - loose or ragged clothing or cuffs
  - greasy or oily clothing, gloves, or boots
  - jewellery, especially rings and earrings
  - sweatpants.
- Keep neck chains under your clothing so they do not hang out. If you have long hair, always keep it tied back.
- Clothing made of synthetic materials can be easily ignited and melted by hot asphalt or electrical flash. Cotton is more flame-retardant and therefore is recommended for work clothes.
- If your skin comes into contact with a dangerous or corrosive substance, wash immediately with water to avoid burns. Remove any contaminated clothing to prevent irritation.
- If your skin comes into contact with hot asphalt it's best to leave it alone and let the hospital staff look after it.
- Pant legs should not have cuffs. Cuffs trap dirt and liquid. Wear your pant legs over your boots, especially when you are carrying or working with hot asphalt. This will prevent spilled or splashed asphalt from getting into your boots and burning your feet.
- Roofers should wear long-sleeved shirts, buttoned at the cuffs. Kettlepersons should also wear protective over-sleeves.
- In the winter, your clothing should cover as much of your body as is practical.
  - Wear a liner under your hard hat.
  - Wear several layers of loose-fitting clothing so you can remove or add layers as the weather or workload changes.
  - The insulation provided by clothing is directly related to the total thickness.
  - Remove or open the outer layers during heavy work or during breaks so that the perspiration can evaporate.

Next to the skin

Synthetic fabrics such as polyester or polypropylene are not recommended for roofers since they burn very easily.

Middle layers

Thickness is the key. Stick to cotton and wool to prevent clothes from catching fire.

Outer layer

The best outer layers resist wind yet let moisture out. Tightly woven, thick wool, or cotton fabrics work best for roofers.

Hand and Forearm Protection

Wear gloves when you are working with metal flashings, hot tar, or bitumen, or when working on the kettle. Gloves that are weather-palmed and cotton-backed with a knit-wrist are best because they offer comfort and a good grip. Gloves should fit snugly at the wrist to keep out hot liquid.

There are new gloves specifically designed for roofers that protect the hands and forearms from burns. These gloves have cuffs that extend above the elbow and are kept in place with Velcro or elastic. If you do not have these gloves, use tape to bind the gloves more tightly to your wrist.

Chemical-resistant gloves

For protection against chemical hazards, the safety data sheet (SDS) for the product being used should say whether gloves are needed and what kind should be used. An SDS must be available on site for all hazardous products.

Table 1 specifies what kind of gloves to wear for protection against various chemicals that may injure the skin. This information can be used if the SDS does not specify the type of glove to be worn. For connecting or disconnecting propane, neoprene gloves are recommended.

WARNING: Ordinary glove materials that are not rated as chemical-resistant do not protect against all hazards. Some solvents, degreasers, and other liquids can penetrate or dissolve rubber, neoprene, or PVC. Always use proper gloves.

Table 1: Glove Selection Chart

Chemical Name	Glove Selection
Acetone	Butyl Rubber
Cellosolve	PVA, PVC, Neoprene
Cellosolve Acetate	PVA, PVC
Cyclohexane	NBR, Viton®
Hexane	Neoprene, NBR, PVA
Methyl Alcohol	Neoprene, Rubber, NBR
Methyl Chloroform	PVA, Viton®
Methyl Chloride	PVA, Viton®
Methyl Ethyl Ketone	Butyl Rubber
Methyl Isobutyl Ketone	Butyl Rubber, PVA
Mineral Spirits	Neoprene
Naphtha	NBR, PVA
Perchloroethylene	NBR, PVA, Viton®
Stoddard Solvent	NBR, PVA, Rubber
Toluene	PVA, Viton®
Turpentine	PVA, NBR
Trichloroethylene	PVA, Viton®
1, 1, 1 Trichloroethane	PVA, Viton®
1, 1, 2 Trichloroethane	PVA, Viton®
Xylene	PVA, Viton®

PVA = Polyvinyl Alcohol
PVC = Polyvinyl Chloride
NBR = Nitrite Butyl Rubber
Viton® = Dupont tradename product

Hearing Protection

If you are working in noisy places or with noisy equipment, you must wear hearing protection. The noise from hoist motors, cutters, sweepers, torches, and other work on site can exceed 85 decibels. Noise at that level is harmful over prolonged periods.

Over time, exposure to loud noise can cause the following problems:

- Noise-induced hearing loss (NIHL)
- Tinnitus (ringing in the ears)
- High blood pressure
- Fatigue.

NIHL is the most common occupational disease suffered by construction workers in Ontario. It often happens gradually, so workers may not realize their hearing is being damaged. By the time they do realize it, it's too late—the damage is permanent and can't be reversed.

A new noise regulation (O. Reg. 381) came into effect in 2016. It requires employers to protect workers from overexposure to noise and sets out a time-weighted average limit of 85 dBA of noise exposure over an 8-hour shift.

If workers are exposed to more than that, the employer must consider using engineering and administrative controls to reduce noise at the source or along the path to the worker. If it is not possible to control noise at the source or along the path, the employer can consider using PPE such as hearing protection devices (HPDs) to control noise at the worker.

The employer must select the proper HPDs based on the jobsite conditions and must provide adequate training and instruction on the HPDs workers will be using. When choosing an HPD, consider the following points:

- **Noise exposure**: Protect against the loudest noise possible with the equipment you operate or in the place where you work.
- **Comfort**: If the type you choose isn't comfortable, you won't wear it.
- **Appearance**: If you don't like how you look with the protection, you may not use it.
- **Communication**: Some hearing protectors actually make it easier to hear other people speaking in noisy places.
- **Safety**: You may feel isolated and unsafe if the protection is so high that you can't hear anything, including speech or warning sounds.

Table 2 provides general guidance in selecting the correct HPD for different noise levels.

Table 2: Recommended Hearing Protection

Level of Noise Exposure LEX (dBA)	Grade	Class
< 90	1	C
< 95	2	B
< 100	3	A
< 105	4	A
< 110	Dual*	
> 110	Dual†	

Adapted from CSA Standard Z94.2-02

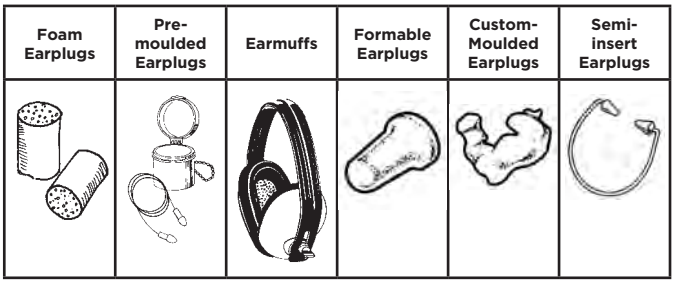
NOTE: Recommendations are based on daily 8-hour exposure.

* Dual hearing protection required. Use a minimum of a Grade 2 or Class B earmuff and a Grade 3 or Class A earplug.

† Dual hearing protection required. It is also recommended that exposure durations be limited, octave-band analysis be conducted for attenuation predictions, and twice-annual audiometry be provided to the affected individuals.

The chart at the right shows some options that are available for HPDs.

If hearing protection is not worn, limit the time you are exposed to high noise levels from equipment and tools. Refer to Table 3 for maximum exposure times without hearing protection for common roofing equipment and tools.



Types of Hearing Protection Devices

Table 3: Noise Levels and Maximum Exposure Times for Common Roofing Equipment and Tools

Equipment	Operating Conditions	Noise Level (dBA)	Maximum Exposure Time (Without Protection)
44-inch Sweeper (5 HP motor)	Running at operating speed	92	1 hr 35 min
	Idle	84	10 hr 5 min
Sweeper vertical shaft (5 HP motor)	Running at operating speed	89	3 hr 10 min
	Idle	84	10 hr 5 min
44-inch Sweeper (11 HP motor)	Running at operating speed	94	1 hr
	Idle	77	>10 hr
Single cutter horizontal shaft (11 HP motor)	Running at operating speed	94	1 hr
	Idle	78	>10 hr
Single cutter (9 HP motor)	Running at operating speed	97	30 min
	Idle	87	5 hr 2 min
Rotary planer (8.5 HP motor)	Running at operating speed	87	5 hr 2 min
	Idle	74	>10 hr
15-inch Rotary planer (9 HP motor)	Running at operating speed	98	24 min
	Idle	84	10 hr 5 min
Gravel spreader (5 HP motor)	Running at operating speed	94	1 hr
	Idle	78	>10 hr
1000-lb Track hoist (8 HP motor)	Running at operating speed	101	12 min
	Idle	89	3 hr 10 min
Diesel-generated trailer-mounted industrial vacuum (6 ft away)	Running–chute closed	96	38 min
	Running–chute open	100	15 min
Burners on kettle (2)	10 psi	85	8 min
	20 psi	104	6 min
Back-pack blower	Blowing snow	101	12 min
Quick-cut saw	Cutting 16-gauge sheet metal	108	2 min
Conveyor (4-cycle)	Running at operating speed	95	47 min
	Idle	87	5 hr 2 min

Protection from the Sun

Ultraviolet (UV) rays are high-energy radiation, more powerful than visible light. There are two kinds of UV rays: UVA and UVB. These rays can cause sunburn as well as mutations in your skin cell DNA, which can lead to cancer.

Sunlight is the main source of UV radiation known to damage the skin and cause skin cancer. There has been an alarming increase in the incidence of skin cancer. Exposure to the sun's UV radiation is widely recognized as a highly preventable cause of skin cancer.

We all see SPF on sunscreen bottles. It stands for sun protection factor. Here's how it works:

- If you normally burn in 20 minutes, an SPF 30 sunscreen that is properly applied will protect you (under the same conditions) from burning for about 600 minutes (20 x 30 = 600), which is 10 hours.
- If you normally burn in 25 minutes, an SPF 15 sunscreen will protect you from burning for 375 minutes (25 x 15 = 375), which is just over 6 hours.

In addition to the harmful effects of the sun's direct rays, some workers may be exposed to indirect UV radiation if they are on or near a surface that reflects sunlight. Reflective surfaces such as concrete, water, unpainted corrugated steel, building glass, and aluminum can increase the amount of UV exposure.

Precautions

- Apply a broad-spectrum sunscreen with a sun protection factor (SPF) of 30 or greater to all exposed skin areas. Be sure to cover your ears and the back of your neck. Apply sunscreen 20 to 30 minutes before you go out in the sun. Reapply sunscreen every two hours.
- If you sweat heavily, you may need to reapply sunscreen more often. Additionally, when clothing is wet, it loses some of its ability to block out the sun's rays. Ensure you have additional dry clothing if necessary.
- Use an SPF 30 or higher sunscreen lip balm and reapply every two hours. Skin cancers can develop on lips.
- Wear UV-absorbent safety glasses (CSA-approved polycarbonate glasses incorporate this feature). Use tinted safety glasses if the tint does not cause a safety hazard.
- Try to find a shaded area for your breaks and lunch.
- Wear clothing that covers as much of the skin as possible. Tightly woven material will offer greater protection as a physical block to UV rays.
- Add UV protection to the back of your neck by using a fabric neck protector that clips onto your hard hat.

Neck Shield for Hard Hats

- Wear a wide-brimmed hard hat designed to protect your face and neck from the sun. Adding a glare guard under the peak of your hard hat will help reduce reflective UV rays.

Sun Shields for Hard Hats

- Examine your skin regularly for any unusual changes. The most important warning sign for skin cancer is a spot on the skin that is changing in size, shape, or colour. The danger signs include any wound or skin patch that doesn't heal properly or scales. Be particularly attentive to any mole that grows or becomes irregular in shape, especially if it is multi-coloured. If anything looks unusual, see your doctor as soon as possible. Skin cancers detected early can almost always be cured.

REMEMBER: Even on cloudy or hazy days, UV radiation can penetrate the atmosphere and burn your skin.

Respiratory Protection

Respiratory hazards include airborne dusts, gases, fumes, mists, and vapours. When these hazards cannot be eliminated, controlled at their source (i.e., by ventilation), or along the path (i.e., by enclosures), respiratory protection is needed.

Two classes of respirators may be used to protect workers from airborne hazards:

1. Air-purifying respirators
2. Supplied-air respirators.

Air-Purifying Respirators

Air-purifying respirators work by cleaning the air as it passes through a filter or cartridge connected to the respirator. There are two main types of air-purifying respirators:

1. **Non-powered** – Air is drawn through the air-purifying filter, cartridge, or canister when the wearer breathes in. A filtering facepiece is one example.
2. **Powered** – A fan forces air through the air-purifier and into the facepiece. A powered air-purifying respirator (PAPR) is one example. It provides more comfort when working conditions are hot and humid.

Air-purifying respirators have limitations and should not be used in the following situations:

- When workers need to be protected from exposure to carbon monoxide
- When their there is not enough oxygen in the air (less than 19.5%),
- When there are very high concentrations of contaminants in the air.

Air-purifying respirators are equipped with a filter, a chemical cartridge, or combination of both. Although there are many kinds of filters for specific hazards, three basic types are used with air-purifying respirators:

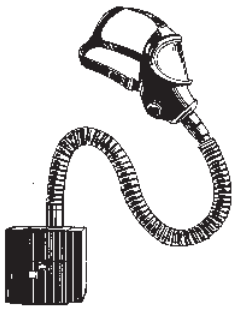
1. **Particulate Filter** - This type removes solid particles such as dusts, fumes, or mists. When a particulate filter fills up with dust or fume, it becomes harder to breathe through but more efficient, since air is being filtered through the layer of particles as well. Particulate filters cannot filter out gases or vapours because the molecules are too small.

   Particulate filters for non-powered air-purifying respirators are divided into three levels of filter efficiency: 95%, 99%, and 99.97%.

   The numbers refer to the percentage of particles the filter can remove, based on the particle size most difficult to trap. Oil has been found to ruin the filtering ability of some filter material.

   Particulate filters have an N, R, or P rating:
   N – Not resistant to oil
   R – Resistant to oil
   P – oil-Proof.

Filtering facepiece



Powered air-purifying respirator (PAPR)

Types of Air-Purifying Respirator

2. **Gas/vapour cartridge** – This type uses substances that absorb or neutralize gases and vapours as they pass through. Unlike particulate filters, gas and vapour cartridge filters become less efficient the longer they are used.

   Some cartridges have an end-of-service-life indicator. This indicator changes colour to warn the user to change the cartridge. If the respirator does not have an indicator, a change-out schedule is needed to calculate when the cartridge needs to be replaced. Consult the respirator manufacturer for guidance on creating this schedule.
3. **Combination Particulate/Gas/Vapour Cartridge with Filter** – This type removes particulate matter, vapours, and gases from the air. It is used where more than one type of hazard may be present.

Supplied-Air Respirators

Supplied-air respirators provide clean breathing air from an uncontaminated source, usually a special compressor located in a clean environment, or from cylinders containing compressed breathing air.

There are three basic types of supplied-air respirators:

1. **Air-line Unit** – relies on a hose that connects the respirator to cylinders of compressed breathing air. An abrasive blasting supplied-air hood is one example.
2. **Ambient Air Blower** – draws air through an inlet hose (positioned where the air is clean) and pumps the air under fairly low pressure to the worker's hood, helmet, or facepiece.
3. **Self-contained Breathing Apparatus** (SCBA) – uses a cylinder of air carried by the wearer. SCBAs are awkward and heavy, and they require frequent cylinder changes. Combination air-line/SCBA units are available for use in confined spaces and other high-risk work where reserve protection is required.

Supplied-air hood SCBA Air-line/SCBA

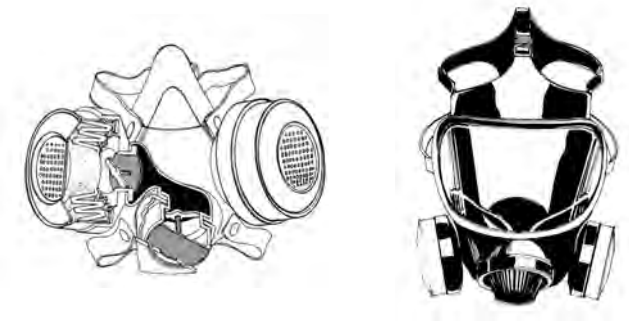
Types of Supplied-Air Respirators

Styles of Facepieces

In addition to the type of respirator, the style of facepiece is used to classify respirators.

Half Facepiece is widely used as an air-purifying respirator with one or more filters or cartridges attached to the facepiece. The silicone, thermoplastic, or rubber facepiece covers the mouth and nose, cups under the chin, and is usually held in place by two straps. It generally provides better protection than quarter-face masks because the chin cup affords a more secure fit.

Full Facepiece covers the entire face and consists of a moulded rubber or plastic frame and a clear visor. Since it fits against the relatively smooth rim of the face, it provides more protection than other face masks. Full-face masks can be used with air-purifying, powered air-purifying, and supplied-air respirators.



Half and Full Facepieces

For help choosing the right kind of respirator for the hazards on site, consult the Respirator Selection Guide (page 8-10).

Fit Tests and Seal Checks

Once a respirator has been selected, it is important to make sure that it fits properly. The only way to do that is to have the respirator wearer fit-tested while it's being worn.

Unlike a respirator fit test, a user seal check is made by users of the respirator each time they wear it. This simple procedure confirms whether there are any leaks in the respirator.

A user seal check. has two steps:

1. **Negative-Pressure Seal Check** — The wearer puts on the respirator and adjusts it so that it feels fairly comfortable. Then the air inlets are blocked with the hands or a plastic cover, and the wearer inhales gently and holds for five seconds. If the respirator is properly fitted, it should collapse slightly and not permit any air into the facepiece. If leakage is detected, the mask should be readjusted and the test repeated until the fit is satisfactory.
2. **Positive-Pressure Seal Check** — The wearer puts on the respirator and adjusts it so that it feels fairly comfortable. Then the exhaust port of the respirator is covered and the wearer tries to exhale gently. The facepiece should puff away from the wearer, but there should be no leakage.

Negative- and Positive-Pressure Seal Checks

Respirator Maintenance

Like any equipment, respirators require maintenance. The following instructions cover the major points. Always keep and read the instructions that come with your respirator for full details.

1. Change filters and cartridges as follows:
   - Dust, mist, and fume filters should be changed when there is noticeable resistance to normal breathing.
   - Chemical cartridges should be changed when warning is given by the end-of-service-life indicator or according to the change-out schedule.
   - Any filter should be changed at the frequency specified by the manufacturer or when damaged in any way.
2. Check inhalation and exhalation valves before the respirator is used.
3. Replace damaged facepiece, straps, filters, valves, or other parts with parts from the equipment manufacturer.
4. Wash facepieces with mild soapy water as often as necessary to keep them clean and wearable.
5. Assign respirators to the exclusive use of one worker, if possible.
6. Disinfect a respirator after each use if it has been assigned to more than one worker. Consult the manufacturer about acceptable sanitizers or disinfectants.
7. Check all supply hoses, valves, and regulators on supplied-air respirators as specified by the manufacturer.
8. Use and maintain SCBA units and high-pressure cylinders of compressed breathing air in accordance with current CSA Standards Z180.1-13 Compressed Breathing Air and Systems, and Z94.4-11 Selection, Care and Use of Respirators.
9. Maintain compressors and filtration systems used with supplied-air respirators in accordance with the manufacturer's instructions.
10. Consult the manufacturer for information on replacing respirator cartridges.
11. Store respirators in a location away from dust, ozone, sun, heat, extreme cold, excessive moisture, vermin, damaging chemicals, oils, and grease. Also ensure the rubber facepiece is not deformed.

Approvals and Standards

The most commonly referenced standards for respiratory protection in North America are the test criteria used by the National Institute for Occupational Safety and Health (NIOSH).

NIOSH is a U.S. government agency which tests and approves respiratory protective equipment as one of its major activities and publishes a list of approved devices annually.

IHSA recommends that only NIOSH-approved equipment be used for protection against respiratory hazards.

The CSA has issued two standards pertaining to respiratory protection, which should be reviewed by the person who is responsible for the respirator program:

1. *Z94.4 Selection, Care and Use of Respirators* offers recommendations on these three aspects of the subject.
2. *Z180.1 Compressed Breathing Air and Systems* lists the criteria for air purity and delivery systems

Respirator Selection Guide

Air-purifying			Supplied-air	
Half facepiece		Full facepiece	Helmet/hood† NIOSH type CE pressure demand Full facepiece pressure demand	SCBA or SCBA + air-line, full facepiece and pressure demand
Filtering facepiece	Elastomeric facepiece			
			Powered air-purifying (PAPR) helmet/ hood† or full face 	

Filter efficiency and type	95	100	95	100	Organic vapour	95+ organic vapour	100+ organic vapour	100	100+ organic vapour	100		
Assigned-protection factor* CSA Z94.4-11	10	10	10	10	10	10	10	50	50	1000	1000	10,000

Roofing Activities												
Removal of roofing material (built-up roofing, no asbestos)	✓ R or P		✓ R or P									
Heat welding roofing membrane	✓ N, R, or P		✓ N, R, or P							✓ Tight-fitting full		
Adhesive welding roofing membrane					✓ N, R, or P							
Roofing kettle operators (asphalt)									✓ N, R, or P	✓ +OV		

N = Not resistant to oil R = Oil-resistant P = Oil-proof OV = Organic vapour cartridge

✓ Indicates suitable protection. If oil mist is present, use R or P filters.

* Assigned protection factor means the anticipated level of respiratory protection that would be provided by a properly functioning respirator or class of respirators worn by users who are properly fitted and trained. Higher numbers mean greater protection. You may use a respirator with a greater protection factor than the one recommended for your task but never use a respirator with a smaller protection factor.

† The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1000 or greater to receive an APF of 1000. Without such information, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

NOTE: These recommendations will provide adequate protection in most circumstances. Factors such as ventilation, duration of exposure, and user characteristics can affect how well a respirator protects you. If unsure about the respirator required for a task, contact the manufacturer or IHSA at 1-800-263-5024 or www.ihsa.ca

9 Fall Protection

One of the biggest hazards faced by roofers is the danger of falling. In Ontario, working at heights training is mandatory for anyone who may be exposed to fall hazards on the job.

Working at Heights Training

In 2015, Ontario introduced a new Working at Heights (WAH) Training Standard. The new training requirements for WAH can be found in the Occupational Health and Safety Awareness and Training regulation (287/13).

Employers must ensure that their workers complete a WAH course that has been approved by the Chief Prevention Officer (CPO) under the Ministry of Labour (MOL). Employers must keep a record of this training. They must also ensure workers complete a WAH refresher course every three years.

In addition, employers must ensure that their workers receive the following:

- Site-specific training on the fall hazards they will encounter
- Site-specific training on the fall protection equipment and procedures they will use
- Adequate oral and written instructions by a competent person on site.

To meet this requirement, employers should ensure that the site supervisor conducts a **Job Safety Analysis/Hazard Assessment** and develops a **Fall Protection Work Plan**.

The supervisor should review the results of the JSA/JHA and the requirements of the FPWP with workers on the site. (See **Chapter 2** for more information on JSAs.)

For more information on these requirements and templates to help you develop these resources, visit the **Fall Prevention and Working at Heights** topic page on the **ihsa.ca** website.

Fall Protection

A means of fall protection must be used wherever workers are exposed to the hazard of falling:

- More than 3 metres (10 feet)
- More than 1.2 metres (4 feet) if the work area is used as a path for a wheelbarrow or similar equipment
- Into operating machinery
- Into water or another liquid
- Into a hazardous substance or object
- Through an opening in a work surface.

Fall Prevention

The best way to protect workers from a fall injury or fatality is to prevent the fall from happening. To be effective, a fall prevention system must be planned in advance. Ideally, the planning should take place at the design stage. In many cases, anchors and other components can be installed at the fabrication stage, before the equipment arrives on the jobsite. Complete a JSA/JHA beforehand to ensure that all fall hazards have been addressed.

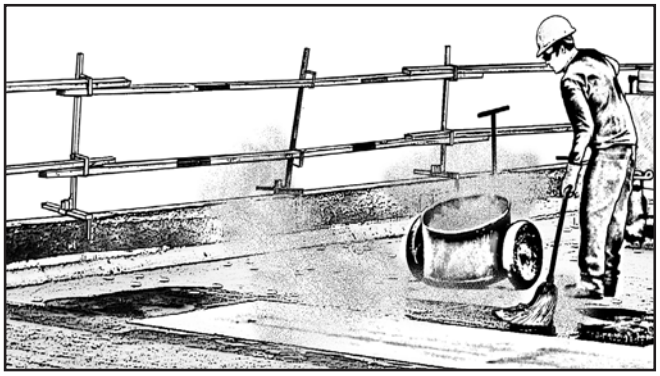
The type of fall prevention system used often depends on the kind of work being done. Regardless of which type is used, every fall prevention system in Ontario construction must comply with the relevant provincial legislation (e.g., OHSA, construction regulations) and applicable national standards (e.g., CSA, ANSI).

Methods of fall prevention can include:

- **Eliminating the hazard** by working on the ground instead of at heights
- Erecting **guardrails or barriers** and covering **roof and floor openings**
- Using personal protective equipment (PPE) such as a **travel restraint system**, which prevents workers from falling over an unprotected edge.

Guardrails

Guardrails are the preferred choice for fall protection. Once they are in place, personal fall protection is not required. However, workers who are installing temporary guardrails must use a fall protection system whenever they are closer than 2 m (6 ft 6 in) to the roof edge.



Guardrail System in Place

Preferably, workers at the perimeter should use a travel-restraint system. If that is not possible, a fall-arrest system with the lanyard tied off to an adequately anchored lifeline must be used.

Portable guardrails may be used for short sections but are not suitable for long runs. Two portable guardrails can be arranged to allow roofing from one edge to another.

Fall Protection When Installing Guardrails

NOTE: It is essential to secure guardrails according to the manufacturer's instructions so that the system will work properly.

Warning Barriers

Guardrails do not need to enclose the whole roof, only the section being worked on. When only part of a roof is being worked on, the work area without the guardrail should be marked by a warning barrier. Warning barriers (i.e., bump lines) should be set up least 2 m (6 ft 6 in) from the perimeter.

The work area is the area where roofing work is taking place within the warning barriers. It can also include sections needed for the delivery, movement, and storage of materials. If workers stay within this zone, no other means of fall protection is required.

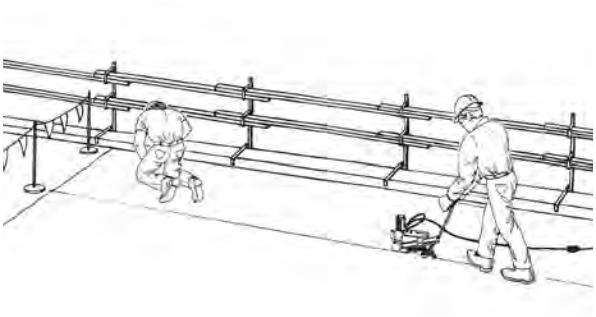
For example, on single-ply roofing, the membrane can be folded back at 2 m (6 ft 6 in) from the roof edge, and a warning barrier set up to separate the work area from the space 2 m from the perimeter.

When work inside the warning barrier is finished, the barrier may be removed. Workers must then use a fall protection system properly tied off and anchored when they are working on the portion of membrane 2 m or less from the roof edge.

When work is done at the edge of the roof, workers must always use a fall protection system unless they are protected by temporary guardrails, portable guardrails, or a parapet wall at least 90 cm (3 ft) high.

Warning Barrier with Danger Sign

According to section 207 (2) of the Construction Regulations, a warning barrier must be 1.1 m above the roof level and consist of portable weighted posts supporting a taut chain, cable, or rope. It should also have flags or warning signs to alert workers that personal fall protection is needed if they go outside of the protected work area.



Use Bump Lines to Designate Unprotected Areas

Any work between the barrier and the roof edge requires a fall protection system, usually consisting of either a portable guardrail, a travel-restraint system, or a fall-arrest system.

The barrier should extend at least 3 m (10 ft) beyond the work area. Several work sections can be set up on a roof.

Travel Restraint

Since it's not always possible to install guardrails, the next best option is to use travel restraint. A travel restraint system lets a worker travel just far enough to reach the edge but not far enough to fall over.

Worker in Travel Restraint

A typical travel restraint system consists of the following CSA-approved equipment attached to adequate anchorage:

- Full-body harness
- Lifeline
- Lanyard
- Rope grab to attach harness or lanyard to lifeline.

To implement a travel restraint system, arrangements must be planned thoroughly. Every fall hazard in the proposed work area must be identified. Careful consideration must be given to the selection of appropriate components and the location of adequate anchor points.

Here are some things to consider:

When identifying the fall hazards, pay special attention to areas with irregular-shaped perimeters, floor openings, or locations near corners.

When selecting an anchor point, choose one that is as close as possible to the centre of the work area and perpendicular to the unprotected edge.

When choosing components, be aware that a fully extended lifeline and/or lanyard that adequately restrains a worker from a fall hazard in one section of the work area may be too long to provide the same protection in another section.

> **CAUTION:** Avoid working at heights in bad weather when possible. Slips and falls are more common when working in harsh environmental conditions.

Fall Arrest Systems

If it's not practicable to use guardrails or travel restraint to prevent workers from falling, the next best option is to "arrest" or stop a fall before the worker hits the ground or an object below, thereby preventing a fatality or critical injury.

There are three methods of arresting a fall. Workers must be protected by the highest-ranked method that is practicable. Ranked in order, these methods are:

1. **Fall restricting system**
2. **Fall arrest system**
3. **Safety net system.**

Before using any of these methods of fall arrest, the employer must develop written procedures for rescuing a worker whose fall has been arrested. (See Chapter 3 for **Working at Heights Rescue Procedures**.)

Fall restricting system

An arrested fall puts a tremendous amount of force on your body, and can sometimes cause serious injury. To minimize that force, always keep your fall distance as short as possible.

A fall restricting system is designed to limit a worker's free-fall distance to 0.6 m (2 ft). This means that less force will be exerted on the body when the fall is arrested. It also means there is less chance that the person will hit the ground or an object below.

The components described under fall arrest systems can be used for fall restricting systems. However, the harness is generally connected at the front (sternum) rather than at the D-ring on the back. This sternal connection is then fastened to a wire rope grab or fixed ridged rail system used for climbing ladders.

Fall Restricting System

Fall arrest system

A fall arrest system must prevent a falling worker from hitting the ground or any object or level below. It must include the following:

- A CSA-approved full-body harness
- A lanyard equipped with an energy absorber (unless the energy absorber could cause a falling worker to hit the ground or an object below)
- An adequate anchor point

The illustrations on the next page show the type of equipment typically used in a fall arrest system. This is similar to the equipment used for travel restraint except that there is an energy absorber attached to the lanyard. This device absorbs some of the force exerted on the body when a fall is arrested.

Full-body Harness

D-Ring Attached to Harness

Locking Snap Hook

Rope Grab Attached to Lifeline

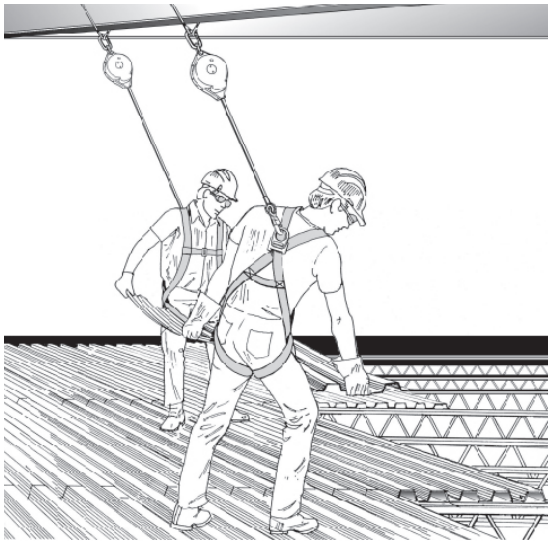
Lanyard With Energy Absorber

Fall Arrest System

An arrested fall puts a lot of force on the body and can sometimes cause serious injury. To minimize that force, always keep your fall distance as short as possible. The lifeline should be kept reasonably taut without a lot of loose line between the worker and the anchor point. A fall arrest system must not subject a falling worker to a peak fall-arrest force greater than 8 kilonewtons.

Self-retracting lifelines (SRLs) are widely used for fall arrest, especially where workers must move about to handle or install materials. They allow the lifeline to extend and retract as a worker moves, but they will stop and lock at any sudden pull.

An SRL is designed to minimize fall distance and the forces exerted on a worker's body by fall arrest. It is usually designed to be anchored above the worker (i.e., vertically). If it is being used horizontally, check with the manufacturer to ensure that it is designed for that type of use.



Self-retracting Lifelines (SRLs)

Safety net system

A safety net system is installed below a work surface where a fall hazard exists to prevent workers from hitting the ground or another level below if they fall.

A safety net must be designed by a professional engineer. It must also be inspected and tested by a professional engineer or a competent worker supervised by them. A copy of the inspection and test must be kept at the project until the safety net is no longer in service.

Safety nets can be used in many places such as around building edges, below formwork operations, and on bridge work. However, a fall arrest rescue plan is still required.

Fall Protection Equipment

When using a travel restraint or fall arrest system, your life depends on the equipment. If it is not certified by a recognized authority, or if it is not properly inspected and maintained, you risk injury and death.

If equipment has been certified by the Canadian Standards Association (CSA), you will find the CSA logo on it. Look for the CSA logo on harnesses, lanyards, energy absorbers, and rope grabs. The label means the equipment has been manufactured to meet high standards.

CSA logo

Fall protection equipment must meet applicable national standards (e.g., CSA, ANSI). The following is a list of the current CSA Standards that pertain to fall protection equipment.

CAN/CSA-Z259.1-05 (R2010): Body Belts and Saddles for Work Positioning and Travel Restraint

CAN/CSA Z259.2.4-12: Fall Arresters and Vertical Rigid Rails

CAN/CSA Z259.2.5-12: Fall Arresters and Vertical Lifelines

CAN/CSA-Z259.2.2-98 (R2009): Self-Retracting Devices for Personal Fall-Arrest Systems.

CAN/CSA-Z259.2.3-12: Descent Control Devices

CAN/CSA-Z259.10-12: Full Body Harnesses.

CAN/CSA-Z259.11-05 (R2010): Energy Absorbers and Lanyards

CAN/CSA-Z259.12-11: Connecting Components for Personal Fall Arrest Systems (PFAS)

CAN/CSA-Z259.13-04 (R2009): Flexible Horizontal Lifeline Systems

CAN/CSA-Z259.14-12: Fall Restrict Equipment for Wood Pole Climbing

CAN/CSA-Z259.15-12: Anchorage Connectors.

Fall protection generally includes the following CSA-approved equipment:

1. A **full-body harness** connected to a lanyard (When used for fall arrest, the lanyard must be equipped with an **energy absorber.**)
2. A **lanyard** connected to a rope grab
3. A **rope grab** connected to a lifeline
4. A **lifeline** connected to an **anchor** point.

CAUTION: It is not advisable to share your fall protection equipment with anyone else.

Full-Body Harness

A full-body harness is attached to the fall protection system and then to a proper anchor. It can be used for both fall prevention (i.e., travel restraint) and for fall arrest.

Full-body harnesses are fully adjustable and available in different sizes. Proper fit is important, especially when it is being used for fall arrest. A full-body safety harnesses must fit snugly and be worn with all the hardware and straps intact and properly fastened. Some types are specially designed for women.

Always refer to manufacturer's instructions for proper use and fit of a full-body harness. Use the following suggestions to ensure proper fit:

1. **Adjust the chest strap so that it's snug and located near the middle of the chest.** A general rule is above the sternum, just below the armpits. In a headfirst fall, a properly adjusted chest strap will prevent the worker from coming out of the harness.

Adjust Chest Strap

2. **Adjust the leg straps so that the user's fist can fit snugly between the strap and leg.**

Adjust Leg Straps

3. **Adjust the shoulder straps so that the back of the D-ring is between the shoulder blades.** A properly positioned D-ring will keep a worker upright during a fall.

Position D-ring Between Shoulder Blades

Inspection

Always inspect every part of a fall arrest system before each use. Consult the manufacturer's instructions for the inspection requirements of your equipment.

When inspecting your harness, make sure that:

- The hardware and straps are intact and undamaged.
- Webbing is free of burns, cuts, loose or broken stitching, frayed material, and signs of heat or chemical damage.
- The D-ring and keeper pads are free from distortion and signs of wear or damage.
- Grommets and buckles are free of damage, distortion, or sharp edges.
- Moving parts move freely through their full range of motion.
- The fall arrest indicator has not deployed.

REMEMBER: When any part of a fall protection system has been used to arrest a fall, it must be removed from service immediately.

Lanyard

A lanyard connects your harness to the rope grab on the lifeline or directly to the anchor. The point where it attaches to the anchorage should be higher than waist level and kept as short as possible to reduce fall distance.

Lanyards are manufactured to specific lengths and can come with or without an energy absorber. Be sure you are wearing the right lanyard for the situation. Sometimes a shorter lanyeard is required. Be aware that the energy absorber will increase the length of a lanyard by as much as 1.1 m (42 in).

- When using a lanyard attached to a rope grab, it can be no longer than 750 mm (30 in).
- Never store lanyards around chemicals, sharp objects, or in wet places.
- Never leave them exposed for long periods to direct sunlight.
- Try to keep the length of your lanyard as short as you can while making sure you are still able to work. This will reduce the likelihood that you will fall over the edge or fall too far.
- Never try to shorten a lanyard by tying knots in it. This is prohibited by law because it can reduce its rated strength considerably.
- Most manufacturers do not permit two lanyards connected to the same D-ring. If you have to move from one lifeline to another, use a Y lanyard. It has two attachment points, so it will allow you to be tied off at all times.

Inspection

- Make sure the lanyard fastens securely to the D-ring on the harness.
- Inspect the lanyard for fraying, kinking, and loose or broken stitching.
- Check the lanyard hardware for rust, cracks, and damage.
- Check for burns or signs of chemical damage.

Inspect Lanyard Before Each Use

Energy Absorber

The energy absorber is the part of a fall protection system that will limit the amount of force a person feels if they are involved in a fall. It is generally integrated into or part of the lanyard that is attached to the full-body harness and the lifeline or anchorage. It can also be purchased on its own and used in a fall arrest system.

Using a lanyard with an energy absorber (commonly called a shock absorber) to absorb some of the energy exerted on the body after a fall has been arrested could save a person's life.

Energy absorbers come in two classifications:

1. Class E4 is for workers weighing at least 45 kg (100 lb), but not more than 115 kg (254 lb).
2. Class E6 is for workers weighing at least 90 kg (200 lb), but not more than 175 kg (386 lb).

One end of the energy absorber must be connected to the D-ring on the full-body harness. The other end connects to the lanyard or is part of the lanyard and connects directly to the anchorage (e.g., the rope grab on the lifeline). In most cases, the energy-absorbing component is enclosed in a snug-fitting jacket to protect it from damage.

Energy-absorbing Lanyard Attached to D-ring

Inspection

- Check the energy absorber regularly.
- Check the cover jacket for stress or tearing
- Many energy absorbers have a tag on the jacket that tears if the unit is exposed to a shock load. Make sure this tag is intact.

Check Cover Jacket for Stress or Tearing

REMEMBER: It is better to prevent the fall by limiting the distance you can travel so that you are kept away from the edge of the roof.

Lifeline

Lifelines connect to an anchor on one end. On the other end, they connect to the user through a rope grab (fall arrester) and lanyard, which connects to the full-body harness. In some cases, especially in travel restraint systems, lifelines can be attached directly to the full-body harness.

Lifelines must comply with the following minimum requirements:

- They must be CSA-certified. Look for the CSA logo on the rope or on the reel (if it came in bulk).
- A vertical lifeline must reach the ground or a level above ground where the worker can safely exit.
- Only one person at a time may use a vertical lifeline.
- A lifeline must have a positive stop (i.e., a manufactured termination) to prevent the rope grab from running off the end of the lifeline.
- Lifelines usually have a diameter of 16-mm (5/8-in) and are made of nylon, polyester, or a polypropylene/polyethylene blend. Different-coloured strands are a good indication that it is an approved lifeline.

Polypropylene/Polyethylene Blend Lifeline

- A polypropylene utility rope is **not approved** for use as a lifeline.

Polypropylene Utility Rope Is NOT a Lifeline

Inspection

Inspect your lifeline and setup before each use.

- Inspect the rope to see if it is in good condition. Check the line for:
  - tears, cuts, or burns
  - strands that are different sizes or shapes
  - broken or loose strands inside the rope (untwist the rope and check inside)
  - an accumulation of powder or dirt inside the rope (untwist the rope and check inside)
  - discoloration and brittleness indicating heat or chemical exposure.
- If you find any of the problems above, consider the line unsafe. Do not use it and remove it from service.
- Make sure the rope grab is compatible with the type of rope you are using for your lifeline. Check the rope grab manufacturer's instructions.
- Make sure the lifeline is protected from rough or sharp edges.
- Store lifelines
  - in a dry location
  - out of direct sunlight
  - away from sharp objects
  - away from corrosive chemicals.
- If an SRL is being used in a horizontal position, check with the manufacturer to ensure that it is designed for that application.
- Check self-retracting lifelines (SRLs) to ensure thay are operating smoothly. Pull the line out and jerk it suddenly. The braking action should be immediate and tight.

Check SRLs for Smooth Operation

Rope Grab

The rope grab, also known as a fall arrester, is a device used to connect the lanyard to the lifeline. This device will move smoothly up and down the lifeline when a steady force is applied, but it will lock when a sharp tug or pull is applied, such as when a person falls. It will remain locked on the lifeline until the applied force is released (i.e., the person is rescued).

> **WARNING:** If you fall, do not grab the rope grab. If you do, some grabs will not work properly and you risk being seriously injured or even killed.

Each rope grab is designed and manufactured for use with a specific diameter (size) and type of lifeline. NOTE: The rope grab and lifeline must be compatible. Specifications are usually listed in the manufacturer's instructions or on the housing.

Check Specifications on Housing

Make sure that the rope grab is attached to the lifeline in the correct direction—not upside down. On most rope grabs, an arrow on the side or top of the housing indicates the proper direction. The arrow must point in the direction of the anchorage.

Inspection

When inspecting your rope grab, check for:

- Damage, cracking, dents, bends, or signs of deformation
- Connecting rings centred—not bent to one side or otherwise deformed
- Rust or sharp edges
- Moving parts that don't work smoothly
- Signs of wear or metal fatigue.

REMEMBER: Always check manufacturer's instructions re: inspection of the specific fall protection equipment being used.

Anchor Systems

The lifeline of a fall arrest system must be fastened to an adequate anchor or to the structure. This anchor must be able to support the weight of a falling worker.

The lifeline should be kept reasonably taut without a lot of loose line between the worker and the anchor. SRLs remain taut automatically.

Choose the location of the lifeline anchorage to minimize the pendulum motion in the event of a fall arrest. This essentially means that the anchorage point should be directly behind the worker—preferably no more than 20 degrees off a line drawn straight back from the worker's position.

There are three main types of anchor systems used for fall protection:

1. **Designed fixed support**—load-rated anchors specifically designed and permanently installed for fall protection as an integral part of the building or structure (e.g., roof anchors on high-rise buildings). Before using designed fixed supports, get assurances from the building owner that they have passed a recent inspection.

   A designed fixed support can be used to anchor a fall arrest system, fall restricting system, or travel restraint system only if the support has been installed according to the Building Code and is safe and practical to use.

Roof Anchor (Designed Fixed Support)

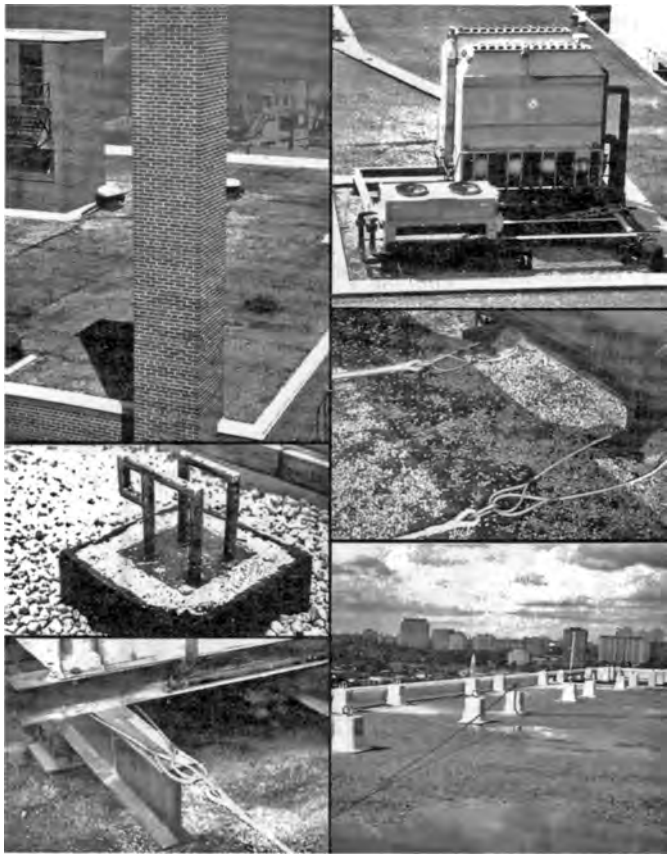
2. **Temporary fixed support**—anchor systems designed to be connected to the structure by a specific method (e.g., nail-on anchors). Temporary fixed support can be used as anchorage if it meets the following conditions:
   1. It can support at least 8 kN (1,800 lb) without exceeding the allowable unit stress for each material used.
   2. When used with a fall-arrest system incorporating an energy absorber, it can support at least 6 kN (1,350 lb) without exceeding the allowable unit stress for each material used.
   3. When used with a travel-restraint system, it can support at least 2 kN (450 lb) without exceeding the allowable unit stress for each material used.

   In all cases, **a safety factor of at least two** should be applied when calculating the minimum load that an anchor point must support.

Nail-On Anchor (Temporary Fixed Support)

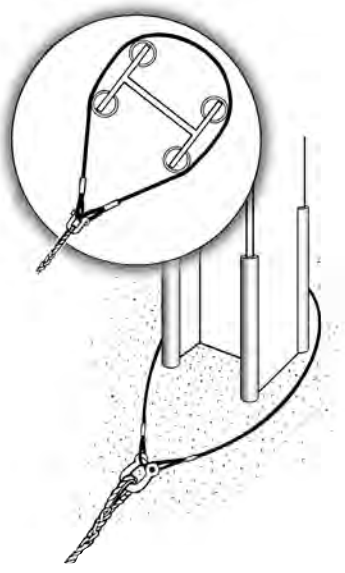
3. **Existing structural features or equipment**—not intended as anchor points but verified by a professional engineer or competent person as being adequate to serve as anchor points (e.g., rooftop mechanical rooms, structural steel, or reinforced concrete columns).

Temporary Anchor Fastened to Existing Structure



Other Examples of Existing Structures or Equipment Used for Anchorage

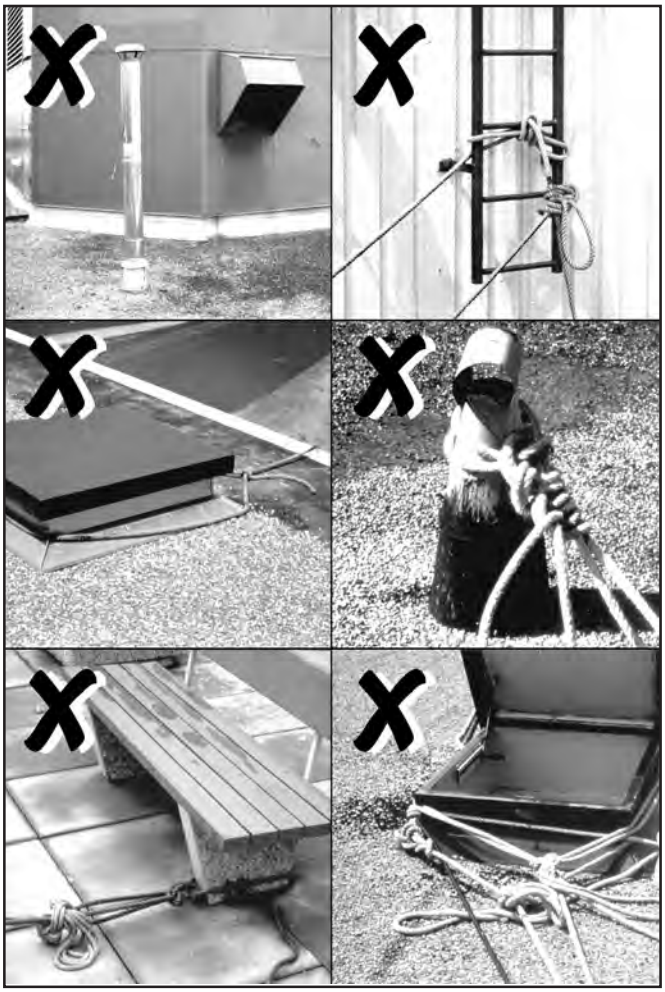
When existing structural features or equipment are used as anchor points, avoid corners or edges that could cut, chafe, or abrade any part of the fall protection system. Where necessary, use softeners such as wood blocking to protect connecting devices, lifelines, or lanyards from damage.



Use Softeners Around Sharp Corners

Never anchor to the following structural features:

- Roof vents or hatches
- Small pipes and ducts
- Metal chimneys
- TV antennas
- Stair or balcony railings.



Examples of Inadequate Anchorage

When no tie-off locations are available, other anchoring methods, such as approved mobile roof anchors, can be used. These devices are either placed on the roof or assembled on the roof as needed.

Always follow the manufacturer's instructions for setup and to find out the acceptable weather and roof conditions for using such devices.

REMEMBER: Choose the location of the anchorage so that it keeps your lifeline at a 90° angle from the edge as much as possible.

Fall Arrest Hazards

If a worker is involved in a fall arrest, it is important to bring that worker to a safe place as quickly as possible without causing further injury or putting rescuers at risk. For more information on creating a fall rescue procedure, see page 11.

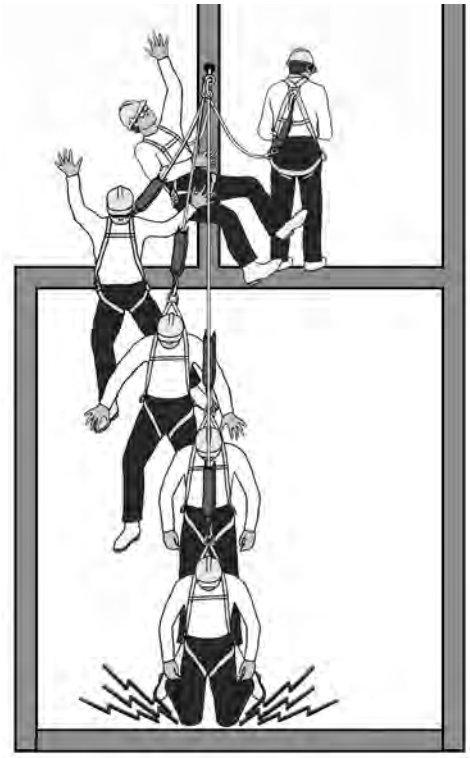
Before deciding to use a fall arrest system, the employer should assess the hazards the workers may be exposed to in case of a fall. As mentioned previously, the preferred method of fall protection is fall prevention. Fall arrest should only be used when all other means of fall prevention such as guardrails, travel restraint, and engineering controls have been ruled out.

Fall arrest hazards include the following:

1. **Bottoming out**
2. **Pendulum effect or swing fall**
3. **Suspension trauma.**

Bottoming out

"Bottoming out" occurs when a falling worker hits a lower level, the ground, or some other hazard before the fall is fully arrested. This happens when the Fall Clearance Distance is greater than the distance from the work surface to the next surface below.



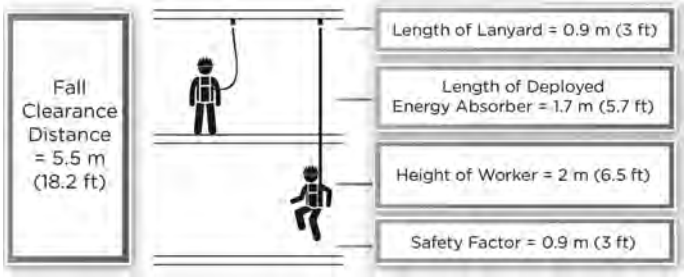
Bottoming Out

Fall arrest systems must be planned, designed, and installed to prevent any risk of bottoming out. To do that, you need to calculate the Fall Clearance Distance. This is the distance from the ground (or object below) to the connection point where the worker attaches their lanyard to the anchor or lifeline.

Once a worker knows the length of the lanyard and length of the deployed energy absorber used in their fall protection system, they can calculate their Fall Clearance Distance and adjust their fall protection system to prevent bottoming out.

The calculation for **Fall Clearance Distance** is:

In the example below, the worker's connection point to the anchor needs to be at least 5.5 m (18.2 ft) from the ground or bottom level.



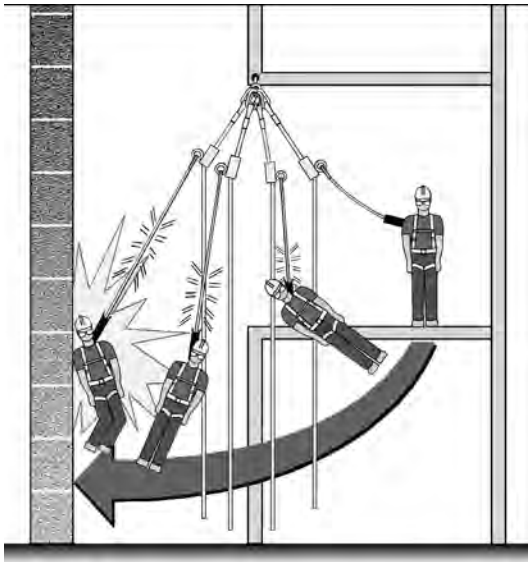
Sample Calculation for Fall Clearance Distance

Pendulum effect

The pendulum effect, also known as a swing fall, occurs when a worker whose fall has been arrested swings from side to side, possibly striking equipment, material, or a structure.

The farther you move sideways from your anchor point (not perpendicular), the greater the chance of swinging if you fall. And the more you swing, the harder you'll strike columns, walls, frames, or other objects in your path. Swinging may even cause your taut lanyard or lifeline to break where it runs over rough or sharp edges.

To minimize the pendulum effect, workers should keep their lanyard or lifeline perpendicular from the edge to the anchor. Where work extends along an open edge, anchor points can be changed to keep lanyard or lifeline perpendicular as work progresses. Another solution is to run a horizontal lifeline parallel to the edge.

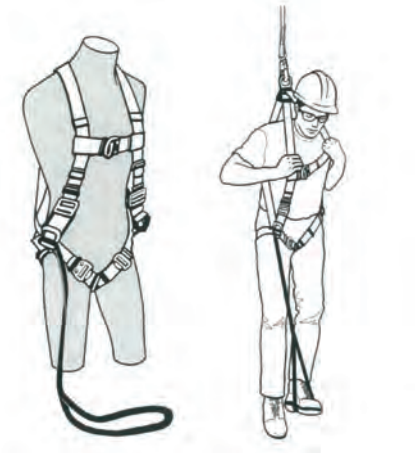


Pendulum Effect

Suspension trauma

A person who is involved in a fall arrest may experience suspension trauma, also known as orthostatic intolerance.

Suspension trauma can occur if a person is suspended in the harness for a period of time. Being suspended in an upright position can cause blood to pool in the legs, depriving the brain of oxygen. This can lead to loss of consciousness, serious injury, or even death.



Suspension Trauma Relief Straps

The best protection against suspension trauma is an effective rescue plan and timely rescue. However, using suspension trauma relief straps or tying a loop for a foothold in the lifeline can help by allowing a conscious worker to relieve the pressure and increase blood circulation.

When emergency services arrive on the jobsite, tell them how long the worker has been suspended so they can take appropriate measures. A worker whose fall has been arrested should be taken to hospital and examined.

Ranking Fall Protection Methods

For an easy way to remember the methods of fall protection and the ranking that must be followed before choosing a method that is most practicable for your site and circumstances, follow the illustration below.

Hazard Elimination

Changing the work process so the hazard no longer exists (e.g., building a roof on the ground and hoisting it into place)

Guardrails, Protective Covers, and Warning Barriers

Prevents a fall from unprotected edges or openings at heights.

Travel Restraint System

Allows a worker to reach the edge of a fall hazard but not fall over it.

Fall Restricting System

Designed to limit a fall distance to 0.6 m (2 ft).

Fall Arrest System

Designed to stop the fall of a worker before they hit the ground or objects below.

Safety Net

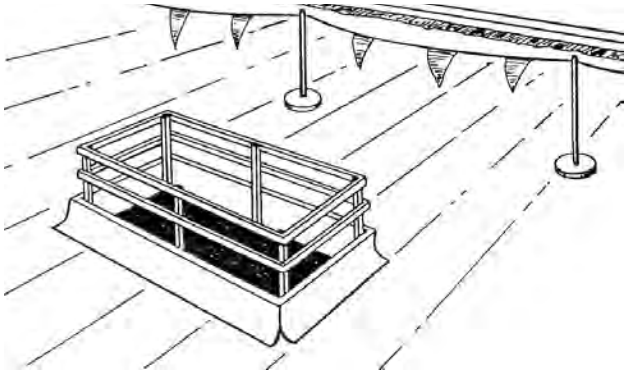
Designed to catch a falling worker before they hit the ground or objects below.

10 Roof Openings and Skylights

Roof Openings

Guardrails must be installed around all roof openings that do not have permanent or temporary covers. However, guardrails may not always be practical. In narrow access routes, for example, the best alternative may be securely fastened covers made of planks, plywood, or steel plates.

If guardrails around openings or hatch covers have to be removed to finish the roofing work, workers must use a fall arrest system. The work area can also be roped off and danger signs posted to warn other workers of the hazard.



Roof Opening Protected by Guardrail

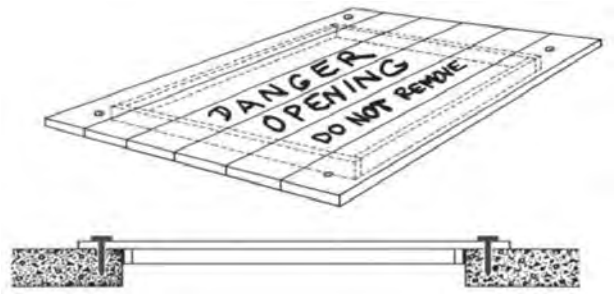
If permanent covers or hatches are installed, they should be kept closed except when the roofing crew is using them for access. If temporary covers are used, they should not extend any more than 15 cm (6 in) beyond the side of the openings they are covering. This will allow most of the roofing work to be done with the cover in place.

According to section 26.3 (2) of the Construction Projects regulation, a protective cover must:

- Cover the opening completely
- Be securely fastened
- Be adequately identified as covering an opening.
- Be made from material that can support all loads that may be placed on it
- Be able to support a live load of at least 2.4 kN (550 lb) per square metre without exceeding the allowable unit stresses for the material used.

Here are some safe work practices when working around roof openings:

- If making a cover out of wood, use full-sized No. 1 spruce planks 48 mm x 248 mm (1-7/8 in x 9-3/4 in).
- Make opening covers stand out with bright paint. Mark it clearly with a warning—DANGER! OPENING—DO NOT REMOVE! DO NOT LOAD!
- Fasten the cover securely to the floor to prevent workers from removing it and falling through the opening.
- Tell the supervisor if a protective cover is loose, not fastened, not properly identified, or in poor condition. However, don't leave the hazard unattended.
- Never stand or walk on a protective cover.
- Never store materials on a protective cover.
- Never drive over a protective cover.
- If an opening is not covered, always use another means of fall protection when working around it.
- If openings are used for access to the roof, they should be surrounded by barriers.

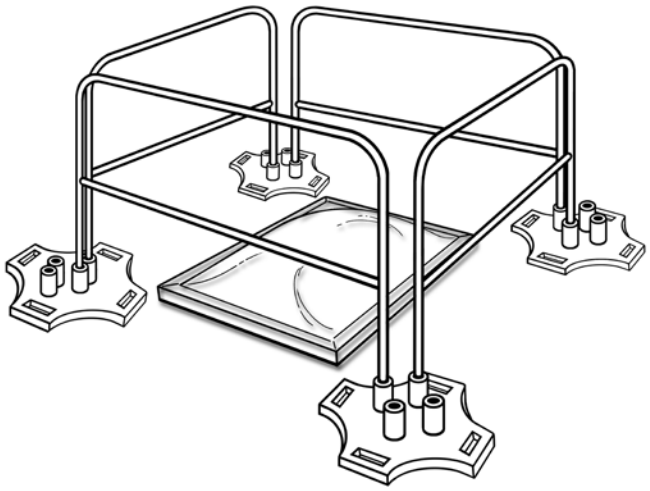


Protective Cover Over Opening

Skylights

Skylights must be treated like other roof openings. While it may seem like the opening is covered, a skylight has very little strength. If a worker were to step on it or fall into it, it could break and the worker could fall to the level below.

To protect against the possibility that a worker may fall through, install temporary guarding around or over each skylight near the work area. It's also a good idea to barricade the skylights on other areas of the roof to keep workers away from them.



Temporary Guardrail Around Skylight

11 Roofing Equipment

Roofers are called on to use many different pieces of equipment. This section provides some general safety tips for working with equipment on roofs.

Employers are required by law to train all their workers in the proper use of the equipment they expect them to use. If workers are not comfortable using a certain piece of equipment, they can tell their supervisor before doing any work with that equipment.

Types of Equipment

These are some common types of roofing equipment:

- Roof cutters
- Sweepers
- Skid steers
- Roof rippers
- Material-handling carts.

Cutter

Powered Cart

Safe Work Practices

- Know the roof capacity before hoisting powered equipment to the roof. Be sure the roof can handle the weight of the equipment and material.
- Always follow the manufacturer's instructions.
- Be sure to operate and maintain all equipment according to the manufacturer's instructions. Use the recommended replacement parts only. An operator's manual should be available on the project.
- Do not modify any equipment unless the modifications are approved by the manufacturer.
- Use all PPE specified by the manufacturer and any additional protection required by your employer.
- Inspect the equipment before using it. Make sure the guards are in place, all controls are working properly, and all nuts and bolts are tight. Check structural welds. Look for cracks and metal fatigue.
- Make sure that no one is in front of the equipment before you start it.
- Shut off the engine when leaving the equipment unattended.
- Never try to override the deadman safety control.
- Inspect your work area before starting work. Look for
  - Guardrails
  - Bump lines
  - Roof openings
  - Other workers in the area who may be affected by your work
  - Obstructions such as vents, hatches, drains, and skylights.
- Never walk backwards while operating.
- Operate the equipment parallel to the roof edge, not at right angles to it. Use fall protection if it is required by the construction regulations or your employer.
- Stay away from roof edges and openings.
- Always be aware of your surroundings.
- Do not start equipment when cutting heads or other components are bearing on the roof surface.
- When possible, reduce dust and fire hazards by wetting down the surface.

Take the following precautions when operating roofing equipment with gas-fuelled engines:

- Check oil and other fluid levels regularly.
- Do not try to repair or adjust the machine when it is running.
- To refuel a gas engine:
  - Stop the engine.
  - Remove all ignition sources, including cigarettes, from the area.
  - Protect the roof from spills by laying material such as plywood under the equipment.
  - Use a funnel.
  - Have a fully charged fire extinguisher available nearby.

Sweeper

Planer

Vacuum Systems

Vacuums are used to vacuum the ballast off the roof and discharge it at ground level. When you are using vacuum systems, take these precautions:

- Keep the discharge area fenced off. The vacuum automatically discharges large quantities of ballast every few minutes.
- When using the vacuum nozzle, be aware of your surrounding and never walk backwards.
- Be sure to understand and follow all the manufacturer's instructions.

Vacuum System

Vacuum Discharge Area

12 Hot-Work Hazards

Torch-Applied Roofs

Torch-applied operations can be dangerous for roofers and the public. The torch can reach temperatures over 1093°C (2000°F). Roofers may suffer serious burns from the torch or the hot modified asphalt they are applying.

In addition, torching applications have been known to start fires that smoulder out of sight, only to burst into flame later, well after the torching is over.

When installing torch-applied roofs, take the following precautions:

- Wear the right PPE, including hard hats, safety boots, eye protection, and gloves. Clothing should be flame-resistant.
- Check the roof surface for combustible material. Remove what can be removed. Enclose the rest in hot- or cold-applied membranes, sealing off all intakes and projections to prevent flame from spreading into combustible material.
- Inspect equipment and torches before using them. They must be in good working order, with fittings, hoses, and head secure and cylinder valves clean.
- Don't use leaking propane equipment. If a leak occurs during operation, stop immediately.
- Store equipment in protective cases.
- When a torch is not in use, set it in its support-leg position with the torch head pointing at an upward angle. Don't rest it on a curb or roof edge.
- Unless you are the torch operator, stay at least 2 or 3 m (6.5 or 10 ft) away from the flame.
- Do not torch directly on cant strips, insulation, wood, grease, lint exhaust, or any other flammable material. Never torch directly at flashing, corners, voids in the roof or roof deck, or behind metal counter-flashings.
- Take extra care when torching near pipes, fresh air vents, and HVAC units because the flame could be sucked into the building.
- Do not torch near gas and electrical lines.
- When shutting off the torch, close the valve of the propane cylinder first. Let the remaining gas in the hose burn off, and then close the torch valve.
- Disconnect the hose at the end of the day.
- Have at least one fully charged 20-lb dry-chemical fire extinguisher within 6 m (20 ft) of each worker using a torch.
- Perform a fire watch every day.
- Never leave lit torch unattended.

The employers must make sure the workers have been trained to install torch-applied modified-asphalt roofing systems. Their training should include the storage, handling, and use of roofing propane.

Hand-Held Torches

Hand-held torches fuelled by 9.1-kg (20-lb) propane cylinders are used for many operations in the roofing industry, such as melting snow and ice, drying roof decks, and heat sealing.

- Never leave torches ignited and unattended.
- Never use hand torches inside a building.
- Make sure the propane cylinder is properly secured and in an upright position.
- Use only approved high-pressure hoses to connect torches to regulators.
- When an operation is finished, always shut off the container valve first. Allow the gas in the system to burn off. After the flame has gone out, shut off the torch control.
- Operate the torch at the manufacturer's recommended pressure.
- Never direct the flame at, near, or toward the cylinder.
- Only apply open flame torches to materials intended for hot surface applications. Do not directly expose open flame torches to combustible materials such as wooden roof decks, cant strips, insulation and flashing, gas lines and electrical cables, or voids, holes, and skylights in the roof or roof deck.

Welding Thermoplastic Membranes

Both automatic and manual systems are used in the roofing industry to weld thermoplastic roof membranes. These systems use electricity to heat air, which in turn welds the membrane together. Air temperatures may reach 600°C (1100°F) and some automatic systems require up to 220 volts. Burns and electrocution are common hazards with this type of equipment.

Workers assigned to operate welding equipment must be trained and certified by the manufacturer of the thermoplastic roof system. Equipment must be maintained according to the manufacturer's instructions.

Roof Membrane Hot-air Welder

Safe Work Practices

Electrical Hazards

- Don't use thermoplastic hot-air welding equipment in the rain or where surfaces may be wet.
- Make sure the equipment is protected from the weather overnight or when not in use.
- Inspect electrical cables regularly for damage.
- Always use ground fault circuit interrupters (GFCIS) when using welders. By law, GFCIs must be used with any portable electrical equipment operated outdoors.
- Do not touch grounded objects such as pipes or scaffolding while operating thermoplastic hot-air welding equipment.

Fire Hazards

- Do not use the equipment near flammable gases or liquids.
- Do not let the equipment remain stationary with the heat on and the welding nozzle close to any surface.

Fumes

- Fumes from thermoplastic welding may irritate the nose and throat. Stay out of the smoke plume, and keep upwind whenever possible. Wearing respiratory protection such as a half-mask N95 respirator will reduce your exposure to the fumes.
- Do not overheat thermoplastic membranes. At normal welding temperatures, very few harmful chemicals are released. But when the thermoplastic is overheated, compounds such as hydrogen chloride and vinyl chloride monomer may be produced.

Steep slopes

- Do not use automatic welding machines on slopes greater than 20 degrees when welding at right angles or greater than 25 degrees when welding in the direction of the slope. Steeper slopes may cause the machine to tip over, stall, or move too fast.

Fire Watch and Plan

The roofing contractor's health and safety policy should provide for an emergency plan and a fire watch after torching applications.

Fire Plan

A fire emergency plan might include instructions like the following:

- Designate a person to be responsible in the event of an emergency.
- Make sure all workers know the escape route.
- Be prepared to call 911 if there is an emergency.
- Have at least one fully charged 20-lb dry chemical fire extinguisher available.

Have a Fire Extinguisher Available

Fire Watch

Provide a fire watch whenever an open flame torch or other ignition source is used for hot surface applications in or on a building. This includes:

- Any area of the building that is exposed as the result of an unprotected roof or wall opening and is located within 5 m (16 ft) of the torch operator.
- Any area where combustible construction materials are located within 5 m (16 ft) of the torch operator.
- Any area where combustibles on the underside of the roof or on the opposite side of walls might be ignited as a result of the torch operator.

Fire watch personnel must:

- Be equipped with PPE and a flashlight or similar portable device when carrying out their duties.
- Be able to sound a warning to other occupants
- Be able to contact the local fire department if required.
- Inspect areas subject to their watch at least once every hour.

The fire watch must be maintained from the first hot application to at least three hours after the last application (or two hours if a thermal imaging camera is used to detect hidden hot spots and it is operated by a competent and trained person who maintains a firewatch log).

Stop torching at least two hours before leaving for the day. At the end of the monitoring period, inspect the building interior (with the owner's representative) before leaving the site.

13 Electrical Hazards

Contact with electricity can cause serious burns or even death. Roofers often have to deal with electrical services that present contact hazards.

Electrical Services in Roof Decking

Cutting into an existing roof for penetrations is a common job for roofers. There is a possibility that electrical services such as conduits or cable could be just beneath the membrane of a roof.

Electrical services may also be connected to the underside of the roof deck on the inside of the building and could pose a hazard as well.

Electrical Conduit on Underside of Roof Deck

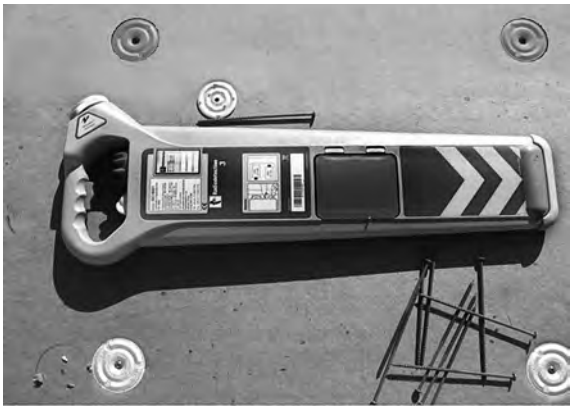
Follow the steps below to prevent an unexpected electrical contact:

- Before cutting into the roof, ask the owner for information on the location of conduits or cable.
- If possible, check the underside of the roof deck inside the building for conduits and cable in the location where the cutting will take place.
- If the roof deck is concrete, have the area scanned or x-rayed before you cut into it.
- Always remove the membrane system before cutting openings in the roof deck.
- If an electrical service is located near the area you're cutting into, ask to have the power shut off and locked out.
- If the power cannot be shut off and locked out, choose a new location to cut into the roof.

WARNING: Contact with electricity can seriously injure or even kill you. Do not cut until you have received confirmation that the area is clear of electrical hazards.

Be aware that the same hazards exist when you are fastening roof membrane mechanically to the decking. If possible, check the underside of the roof deck inside the building for services. Two-way communication between someone watching from inside the building and someone on the roof may be necessary.

Radio detection is becoming a reliable way to check for electrical services close to the roof. Before fastening the roof membrane to the decking, a worker scans the area with a radio detection device and marks areas of concern. This method can lower the risk of electrical contact.



Scanning Device for Electrical Services

If any unknown electrical service lines are found on a rooftop, they should be considered energized and dangerous. If the unknown service affects your work, ask the owner to have the service disconnected while work is being done. If that is not possible, perform a risk assessment or JSA to identify the hazards and ways to control them.

NOTE: If electrical services are found and there is a risk of touching them, investigate alternatives to fastening mechanically to the deck.

For more information about electrical safety, refer to IHSA's *Construction Health and Safety Manual* (M029).

Powerlines

In many cases, the power feed to a building is on the roof. Powerlines can be deadly if you touch them. Here are a few tips for preventing accidental contact with powerlines:

- Before starting work, find the powerline into the building and assess the hazard.
- When working near overhead powerlines, use ladders made of a non-conductive material (fiberglass or wood).
- If you determine the powerline is a hazard, ask to have it de-energized. (See section 190 or 191 of O. Reg. 213/91, as applicable.)
- If de-energizing is not possible, arrange for protective insulation to be placed on the line by contacting the local power authority. Even then, you must maintain a safe working distance from the powerline. Insulation cover-ups can protect against some accidental contact but do not provide enough protection to consider the line isolated or de-energized.

Powerline with Protective Insulation

WARNING: Powerline covers do not prevent electrical shock. Their purpose is to warn of an electrical hazard.

Take precautions when operating hoisting equipment such as a crane near an energized overhead electrical conductor. Even equipment such elevating work platforms, ladders, and rolling scaffolds have made accidental contact with overhead powerlines.

Plan your work so that you avoid powerlines wherever possible. If you must work near powerlines, make every effort to de-energize, move, or insulate the lines. Follow the precautions outlined in the Construction Projects regulation (213/91). Section 188 lists the safe distances when working around powerlines.

Safe Working Distances from Powerlines

Voltage Rating of Powerline	Minimum Distance
750 to 150,000 volts	3 m (10 ft)
150,001 to 250,000 volts	4.5 m (15 ft)
Over 250,000 volts	6 m (20 ft)

Source: O. Reg. 213/91, s. 188

Lightning

Roofers have been seriously injured and killed by lightning. Below are some ways to protect against this hazard:

- If you are on a roof or ladder and you hear a storm coming, get down to the ground and take cover inside.
- If you are inside, stay away from windows or doors and do not touch electrical equipment, metal walls, or other conductors.
- If you are in the open during a thunderstorm and you can't get inside, stay away from trees, hills, and water. Make yourself as small a target as possible, but never lie down on the ground. Instead, crouch down in a baseball catcher's stance, put your hands on your knees, and duck your head.
- Count the length of time between seeing the lightning and hearing the thunder. Every second represents about 300 m. So 6 seconds means the lightning is about 2 km away. However, lightning can reach you even if the storm is 16 km away and there's a clear sky above you.
- Use the 30-30 rule: take shelter when the lightning is 30 seconds away or closer. Stay inside until 30 minutes have passed since you last heard thunder or saw lightning.

Generators

Use the following safe work practices when working around generators:

- Operate generators outside only, because they produce large amounts of carbon monoxide (CO).
- Keep them away from workers to reduce their exposure to noise.
- Don't leave extension cords attached to the generator when it is not being used—cords are a tripping hazard.
- Use an outdoor type 300V or 600V cord.
- To prevent damage to tools and cords, use heavy-gauge wire (12 AWG is ideal) for long runs or big tools.
- Protect cords from hazards like hot asphalt, water, and sharp edges.
- Roll up cords after you have finished with them.
- Use a cart or dolly to move large or heavy generators or get someone to help you.
- Store fuel away from sources of ignition, and give the engine time to cool down before refuelling.
- Follow the manufacturer's instructions for proper grounding. Use only generators labelled "NEUTRAL BONDED TO FRAME".
- Always use ground fault circuit interrupters (GFCIs). Install the GFCI close to the generator (if it is not built into the generator). Test the GFCI after you have grounded it.
- Have a 4A:40BC-rated fire extinguisher ready and know how to use it.

Portable Generator

Natural Gas Piping

Natural gas pipes are found on many roofs. They are used primarily to feed rooftop air-handling units. Gas pipes are often yellow in colour, which makes them easy to recognize.

Below are some precautions to take when working around natural gas pipes.

- Gas lines should be inspected before roofing work begins.
- If gas lines appear to be in poor condition, have them checked for leaks.
- If gas lines interfere with roofing work, have them disconnected.
- Be careful when installing ramps over gas lines. Most roofing operations require hot work, and if a gas line leaks or breaks, there could be an explosion.
- Be cautious when working around energized rooftop units such as HVAC.
- If a gas pipe is disturbed, the connections at the rooftop unit could be damaged. They should be tested for leaks.
- Avoid torching around natural gas pipes.
- Make sure gas pipes are supported properly during roofing work.

Be Careful When Installing Ramps over Gas Lines

Unknown Electrical Services

If unknown electrical service lines are found on a rooftop, they should be considered energized and dangerous. If the unknown service line affects the work, ask the owner to have the service disconnected while the work is being done. If that is not possible, follow the precautions described in the following sections.

Solar Panels (Photovoltaics)

Solar panels, also known as photovoltaics or PVs, are installed on racks and mounted on roof-penetrating support stands or installed on curbs or sleepers. The most popular method of mounting these systems on existing buildings is to ballast the racks.

Ballasted PV system

PV cells are grouped into modules that collect and convert solar radiation into direct current (DC) electricity. A group of PV modules mounted on a support structure or rack is referred to as a PV array. Some PV systems called "building-integrated photovoltaics" (BIPV) attach the PV modules directly to the roof surface.

How Do They Work?

Inverters built into these systems convert the DC current to alternating current (AC). These rooftop assemblies are most commonly rated at 250 kilowatts (kW). However, they may exceed 500 kW with greater than 600 volts. And here is the danger for the roofing worker—because rooftop PV modules are energized with DC current.

Effect on Roofers

Roofing contractors normally employ both service and maintenance crews. Service crews are often sent to a customer's building to repair roof leaks or other failures in the roofing system. Rooftop maintenance, on the other hand, is generally preventive work where crews make non-emergency alterations to the roofing system.

When access to the roofing membrane and flashings is restricted, it is difficult for the roofer to make the necessary repairs.

More and more, roofs are being used for purposes other than weather protection. Roofing membranes are often buried or unreachable. The increasing number of rooftop PV systems is adding to this problem.

Regardless of whether the PVs are integrated or ballasted, they make it harder for roofers to work on the membrane system. The ballasted procedure is a particular problem because the ballast support pads sit directly on the roof.

Safe Work Practices

- Rooftop PV panels are live with DC current. As long as they are exposed to light, they cannot be switched off. Before the roofers go onto the roof, they must be warned that the panels are there. They must not enter these areas without a representative of the owner, and that person must understand how the PV system works and where the essential components are.
- An array of conductors connected to PV modules that are exposed to light remain energized even after they have been disconnected at the junction boxes, combiner boxes, and inverters. Roofers must guard against accidentally touching any exposed part of a PV array conductor. They should inform the building owner of any electrical dangers they encounter and refuse to do the work until the roof area in question has been made safe.
- Many PV systems are designed to provide maximum coverage over the building's rooftop. It is not unusual to find the panels and racks installed right up to the edge of the roof. These types of installations make it particularly difficult for roofers to follow the usual fall protection procedures. Before doing any roofing work on these buildings, make sure that a hazard assessment is done to determine how best to employ fall protection and other safety procedures.
- It is a good idea for companies to revise their safety programs and policies to include procedures for working around rooftop PV installations. Those programs should include additional training for workers who may be exposed to PV systems.

NOTE: Ponding or standing water around PV systems creates a hazardous work situation. Keep that in mind when planning your work.

For more information about solar panels, refer to IHSA's *Safe Practices for Working On or Around Photovoltaic Systems* (M072).

14 Roof Access

Stairs or Elevators

Whenever possible, roofers should use existing stairs or elevators for access to the roof. Where that is not possible, scaffolds or ladders can provide a safe means of access if they are set up and used properly.

Scaffold Stair Towers

Safe access to the roof is of the utmost importance; that is why it is becoming more and more common in the roofing industry to use scaffold stair towers for roof access.

Scaffold stair towers provide several benefits:

- They specify where workers can get onto the roof and can be positioned to provide access at the safest place.
- They have none of the risks associated with ladders.
- It is safe and convenient to carry things while climbing to and from the roof.

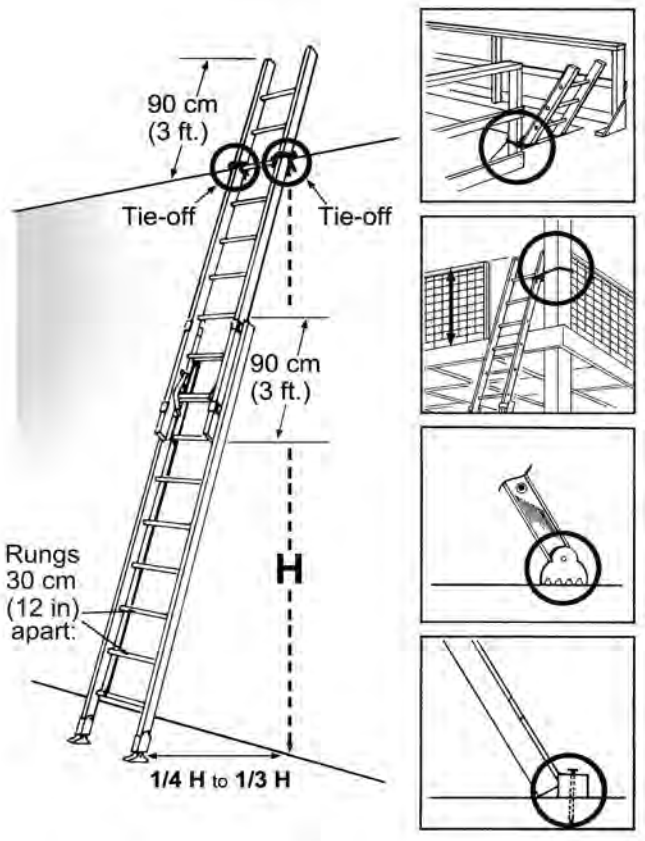
Remember, the erection of a scaffold stair tower must be supervised by a competent worker and done in accordance with the manufacturer's instructions and the construction regulations.

Scaffold Stair Tower

Ladders

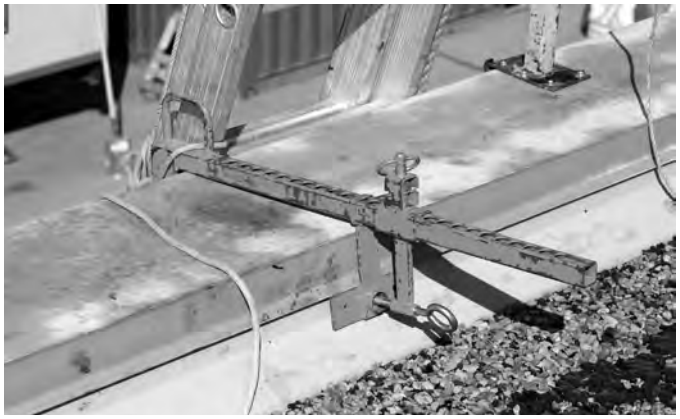
If there is no other means of access, such as stairs or a scaffold stair tower, ladders may be used. Ask for help when installing access ladders.

- Ladders must:
  - be in good condition
  - comply with Sections 78–84 of the construction regulations (213/91)
  - be tied off or secured to the structure at both the top and bottom
  - be set up so that a slope of at least 3-to-1 and not more than 4-to-1 (vertical to horizontal) is maintained for sloped ladders
  - extend at least 90 cm (3 ft) above the roof access level
  - be no longer than 20 m (66 ft) in the case of sloped ladders
  - be kept free of material, garbage, and debris at the top and bottom and be cleared of ice, snow, and other slippery substances
  - for vertical ladders, be equipped with a cage or ladder climbing device with rest platforms no more than 9 m (30 ft) apart
  - not be used as a work platform.



Proper Ways to Secure a Ladder

- Do not carry materials and equipment up or down access ladders. Tools should be carried in a tool pouch or be hoisted by rope.
- Always face the ladder when climbing up or down.
- Maintain three-point contact (two hands and one foot or two feet and one hand) at all times.
- If there are no guardrails where the ladder reaches the roof, a barrier such as a bump line should be set up to warn workers that the edge is nearby.
- Before setting up straight or extension ladders, check the area for overhead powerlines. Never use ladders made of aluminum or other conductive material near powerlines.
- Use an extension ladder for access/egress up to 18 m (60 ft).



A Parapet Clamp Can Be Used to Secure Ladder

WARNING: It is not advisable to rely on permanent exterior fixed ladders as a means to access a roof. Many of these ladders have not been maintained or inspected since being installed, and they may be in poor condition.

Fixed Access Ladders May Be in Poor Condition

15 Material Loading

Hoisting and Rigging

To roofers, rigging means overhead lifting. For safe rigging, you must

- know the weight of the load to be lifted
- know the capacity of the hoisting device
- know the safe working loads of the ropes and hardware
- never hoist over other workers or the general public.

A rigging or hoisting location should be clear of public entrances and access ways, emergency exits, fire escapes, and powerlines. (For safe working distances from powerlines, see p. 13-2).

In addition, when hoisting, try to avoid parts of the building that can be easily damaged, such as windows, cladding or siding, and light fixtures. If that is not possible, provide protection.

Loading and unloading areas on the roof should be protected by a guardrail. If guardrails have been removed to hoist material and you are working less than 2 m from the edge, use a fall protection system that includes a full-body harness, preferably a travel-restraint system.

Before using the hoisting equipment, inspect it for defects and damage. Make sure the weight of the load does not go beyond the capacity of the hoist. Also, make sure the loading areas can support the additional load of roofing material.

Land materials at least 2 m from the edge of the roof or from openings. That keeps workers from having to approach the edge. It also helps to prevent materials from falling over and rolling off the edge.

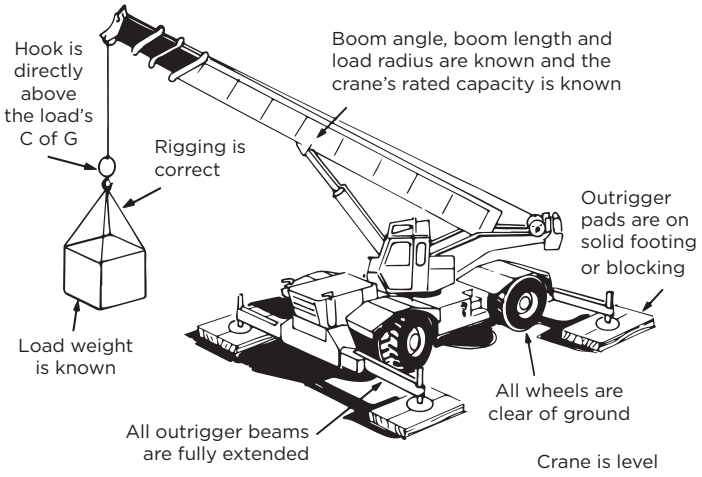
Cranes

Before hoisting operations begin, a crane must be set up for lifting, and certain conditions must be met.

Know and follow safe rigging procedures. For more information, see IHSA's *Hoisting and Rigging Safety Manual* (M035).

Use international hoisting hand signals (see page 15-4) or two-way electronic communication. Employers must make sure the signaller has received adequate training. Before hoisting, the signaller and the operator must agree on the procedures they intend to follow during the lift.

Make sure that the crane can reach the drop-off point and the pick-up point and that the load is properly secured. The drop-off point on the roof should be as close to the installation or storage point as possible and must be at least 2 m from the roof edge or any roof opening.



Correct Crane Setup

Elevators

When a high-rise building is being roofed, hoisting equipment often needs to be transported on the elevator. When work has begun, workers often use the elevator for getting up onto the roof or getting down to ground level.

- Do not load the elevator beyond its lifting capacity.
- Protect the elevator from damage and from bitumen, solvents, and rough or sharp objects.

Motorized Hoists

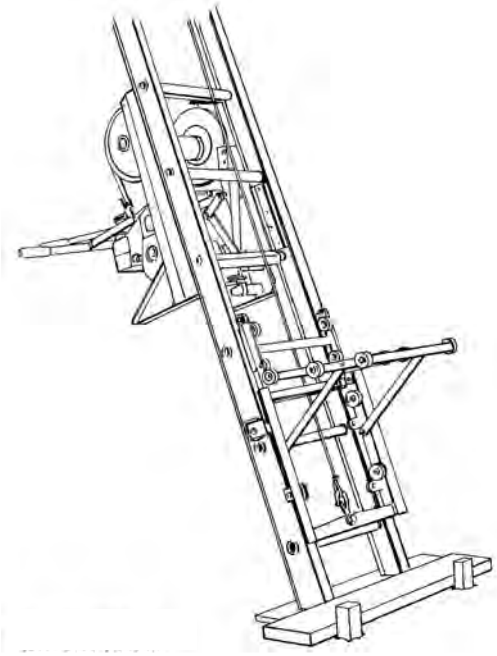
There are three types of motorized hoist:

- Ladder hoist
- Conventional hoist
- Hydraulic hoist.

Ladder Hoists

When setting up a ladder hoist, follow the ladder principle. The slope should be 3:1 or 4:1. That's one foot out for every 3 or 4 ft up. The top and bottom of the ladder must be secured.

Refer to the ladder section in Chapter 13 for additional considerations.



Ladder Hoist

CAUTION: Never use a hoist to transport people.

Conventional and Hydraulic Hoists

The conventional powered hoist is the most popular in Ontario because it is inexpensive. However, it has the drawback of using the two-lever clutch and brake system. This makes it more difficult to operate than a hydraulic unit, which is operated with a switch.

When roofing hoists are located at the edge of the roof, there must be guardrails that extend at least 90 cm (3 ft) on both sides of the frame and that are set up in accordance with the manufacturer's instructions. Wherever possible, a roofing hoist should be set up at least 3 m (10 ft) from an outside corner.

Where the hoist must be set up closer to a corner, an additional guardrail must be attached to the guardrail on the hoist and a warning line set up to protect workers from the second edge.

A hoist must be erected so that the cable remains vertical at all times while a load is being hoisted. In addition, the hoist arrangement must have a safety factor of not less than three against overturning.

When workers are in the hoisting area, they must be protected from fall hazards with guardrails or a secondary means such as a fall protection system.

When preparing to use a hoist, take the following precautions:

- Make sure the hoist is inspected and is fit for safe use before it is delivered to the jobsite.
- Do not overload the roof with counterweights and roofing material.
- Assemble the frame and hoist away from the edge of the roof. Move it to the edge once the assembly is complete.
- Protect the roof when assembling, dismantling, and operating the hoist.
- Secure all counterweights to the frame.
- Use the counterweights suggested by the manufacturer, with the weight marked. Do not use roofing material.
- Inspect the hoist every day. Look for things like loose bolts or pins, cracked or frayed cable, bad welds, and other defects.
- Keep the hoist's instruction manual at the jobsite.

The operator of the hoist must

- be competent to operate, assemble, and dismantle the hoist
- never exceed the load rating capacity.
- make sure the load is always secure and all workers are clear of the hoisting area
- be sure the hoist is never adjusted or repaired when it is running
- use a tag line when there is a danger the load may swing or drift out of control
- make sure the hoisting area is barricaded from the public
- make sure that communication is clear and reliable. Use hand signals or two-way electronic communications when necessary.

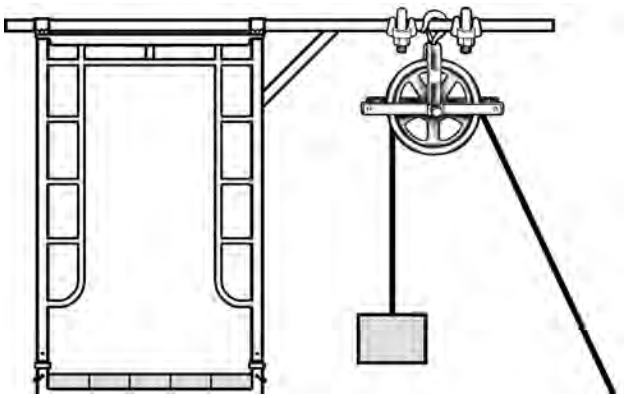
Typical Roof Hoist System

CAUTION: Use a sling to tie a choke hitch on material. Do not loop the hoisting cable around the hook.

Improper set-up or operation of powered hoists can cause injuries. For more information, refer to Appendix B for IHSA's *Health and Safety Advisory: Safe Guarding Around Powered Trolley Hoists* (W457).

Gin Wheels (Hand Hoists)

A gin wheel is an ideal hoisting device in low-rise buildings (three floors or less). For buildings taller than three floors, if possible, use a gin wheel only to transport the counterweights and the hoisting frames for larger projects or the materials for smaller jobs such as repairs.



Gin Wheels Can Be Used for Hoisting Small Loads in Low-Rise Projects

Asphalt Pipes and Discharge Area

Where hot asphalt is pumped to the roof and discharged into a container or similar device within 2 m (6 ft 6 in) of the roof edge, a guardrail or barrier should be installed at the roof edge.

In addition, the pipe supplying the asphalt should be adequately supported and fixed in position so that it cannot present a hazard to workers on the roof if it moves or bends.

A hot-asphalt container or similar device supplied by the discharge pipe must be fixed or blocked in position and the pipe fastened securely to it. The discharge area is dangerous. Limit access to it with barricades, and keep the area clear of all material, tools, and debris.

Asphalt Pipes at Roof Level

Conveyers

A conveyer is another means of moving ballast from the ground to the roof. The ballast is generally loaded into the hopper with a loader or skid steer. Because of the danger from moving equipment, access to the area should be restricted.

Conveyers are designed to move gravel only. Equipment and personnel must never be moved on a conveyer.

Material Conveyor

HOISTING Hand Signals

16 Kettles and Tankers

Bitumen Kettles

According to the Ontario Fire Code, bitumen kettles must meet the following requirements:

- They must be provided with metal lids that are close-fitting and constructed of steel with a minimum thickness of No. 14 sheet metal gauge (2 mm)
- They cannot be located in a fire access route or within 3 m (10 ft) of a building exit or means of egress.
- They cannot be located on the roof of a building or inside it. However, they may be located on a concrete roof if roof openings within 15 m (50 ft) are diked to prevent spilled asphalt run-off.
- When in operation, a bitumen kettle must be supported and level with most of the weight off the tires and legs. It must not be heated above 260°C (500°F) and it must be kept clear of combustible materials and free of excessive amounts of residue.
- An operating bitumen kettle must be under continual supervision by a person who is knowledgeable of operations and hazards. That person must have training in the use of the available portable extinguisher(s).
- Daily and after each use, any mops used for spreading bitumen must be kept in a safe location that is at least 3 m (10 ft) away from buildings and isolated from other combustibles.

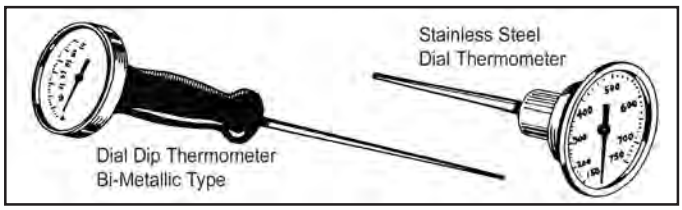
Kettleman at Work

Kettle Start-Up

- Set kettles on smooth, level ground to create an even distribution of asphalt in the kettle and prevent pumping problems. The area must be clear of flammable debris or materials, well ventilated, and as close as possible to the place where the asphalt will be applied.
- Make sure that the rear leveller leg is in a secure down position.
- A fully charged fire extinguisher of at least 4A4OBC rating should always be available near—but not on—the kettle.
- Whenever possible, protect kettles from the wind.
- Before lighting the burner, check the kettle vat for moisture. Moisture in hot asphalt will cause foaming and bubbling. This can cause the scalding asphalt to overflow or splatter. Make sure you know the flash point and working temperature. These temperatures should never be exceeded.
- Check to make sure discharge pipes are clear and free of solid asphalt before pumping
- Make sure the kettle and pump are in good working condition and the pump is strong enough.
  - Check equipment pump lines and fittings for defects and incorrect installation.
  - Make sure the pump line valve is working properly.
  - Guards must be placed so as to enclose pump gears and sprockets.
- Before firing, check the hoses, gauges, fuel tanks, burners, and other equipment for defects and leaks and make sure the kettle lid fits tightly.
- Propane gas cylinders must be secured in an upright position at least 3 m (10 ft) from the kettle burner.
- Never light the burner while it is in the burner well. If there is too much propane in the well, there may be a flashback. Use the size of burner specified by the manufacturer. Never use oversized burners. They may cause the tubes to become overheated, resulting in a fire or explosion.
- Light the burner outside, and then place it in the heating tube. Remember that flames are hard to see on a bright day. Burners should never be fired at full thrust until there's at least 15 cm (6 in) of melt covering the heating tubes.

- Put the burner in a safe spot when it is removed from the kettle.
- Always turn off the burner and engine before refuelling. Sparks from a running motor can ignite the fuel vapours.
- At night, secure the burners, lid, draw-off cock, and fuel.
- Support and secure the pipeline to prevent kinking and unwanted movement.
- Check the temperature periodically with a hand-held thermometer. Also check the melt temperature. A thermometer can be used to calibrate kettle gauges.

WARNING: Many kettle temperature gauges do not work properly.



Hand-held Thermometers

Loading Kettles

- Adding cold asphalt to the kettle can be a dangerous operation. Wear the proper protective clothing, a CSA-certified face shield, protective glasses, long sleeves, and oversized roofers gloves.
- Cut cold asphalt into small chunks so that it won't cause the hot asphalt to splash when it's put into the kettle.
- The kettle should never be filled up. Asphalt expands when it's heated, and it may overflow. Heat cold material slowly.
- The material should not be heated above 260°C (500°F).
- The burners should not be fired at full thrust until the heating tubes are covered with at least 15 cm (6 in) of melt. Firing the burners at full thrust will damage the tubes and crack the burner.
- Try not to stir the hot asphalt by hand. If it must be stirred by hand, use a long, solid piece of wood. Never use a hollow pipe because moisture in the pipe can cause the hot material to flow up through the pipe and burn you.
- Keep the inside and outside of the kettle clean and free of debris and flammable material. A buildup of asphalt can create a fire that is very difficult to extinguish.

Kettle Fires

If there is a kettle fire:

1. Turn off the fuel supply at the tank and close the kettle lid.
2. Call for help.

Always Keep a Fully Charged 4A40BC Fire Extinguisher Nearby

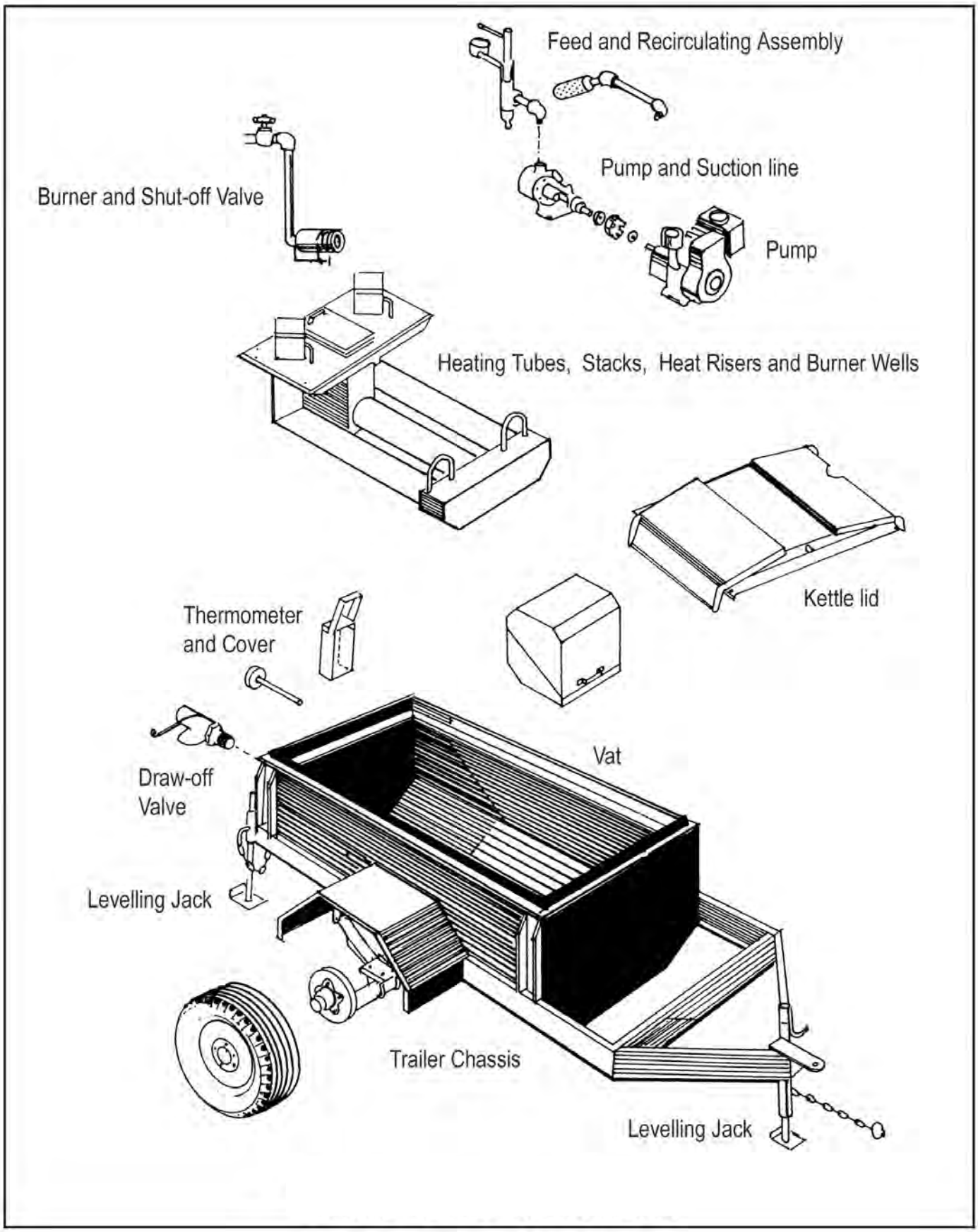
Shutting Down Kettles

When shutting down a kettle, follow these steps:

1. Turn the fuel off.
2. Turn the burners off and remove them.
3. Close the lids and lock them.
4. Lock the drain cock.
5. Lock the pump cowling.
6. Secure the area.

NOTE: Before leaving a kettle at the end of the day, the kettleman must make sure each of those things has been done.

Always refer to the manufacturer's instructions for specific shutdown procedures.



Typical Kettle Components

Rooftop Kettles

Bitumen kettles must not be located on the roof of a building or inside it. However, they may be located on a concrete roof if roof openings within 15 m (50 ft) are diked to prevent spilled asphalt run-off.

This requirement of the Ontario Fire Code applies to existing occupied buildings and additions to existing occupied buildings.

If kettles must be located on the roof, extra precautions must be taken.

- Have at least twice the required number of fire extinguishers on hand.
- Make sure that someone is tending the kettle at all times.
- Set the kettle on a non-combustible surface.
- Locate the kettles away from walls and access ways.
- Do not allow the asphalt to overheat.
- Put up barriers to restrict access to the kettle area.
- Have an emergency plan.

Emission Control System on Kettles (Smokeless Kettles)

Dipsticks

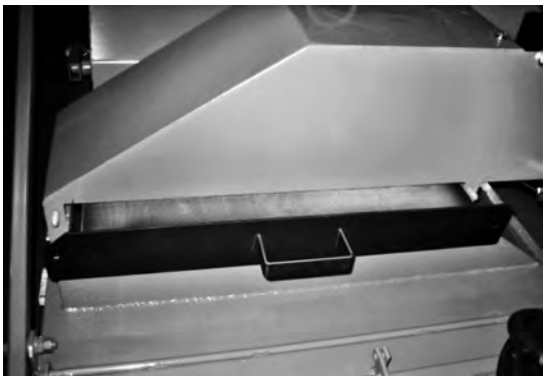
It is important to monitor the asphalt level. There must always be at least 15 cm (6 in) of asphalt above the tubes.

Kettles with emission-control systems come with dipsticks for installation on the kettle. The dipstick must be checked constantly for an accurate measurement of the asphalt level inside the kettle.

Safety Loaders

Safety Loader

- Always use the safety loader to load chopped asphalt into the kettle. After loading the chopped asphalt into the loader, shut the lid and make sure the lid lock catches.
- Use the roll bar to dump the chopped asphalt into the kettle. Make sure the roll bar returns to the closed position. If it is blocked and doesn't go back to the closed position, the operator could be exposed to asphalt smoke the next time the lid is opened.
- The double screens provide protection against flames in the event of a blowback. They also prevent asphalt from splashing up into the burner area.
- Never start the emission control system without the fire arrester screens in place. It could cause a kettle flash and serious injuries.
- Clean the screens at the beginning of every work day. If there are any cuts or holes, the fire screens must be replaced.
- Follow all the manufacturer's instructions.
- The afterburner should always be running when the emission lid is installed on the kettle. Watch continually to make sure the burner is lit, because the wind can blow the flame out.
- Never touch the burner stack on the emission control system. It is hot and will cause burns.
- The propane tank must be at least 3 m (10 ft) from any source of ignition. Large propane tanks must be 7.6 m (25 ft) away. When you're shutting down for the day, turn off the cylinder valve first and let the existing gas burn out. Then shut off all the other valves.



Fire Arrestor Screens (Filters)

NOTE: It takes longer to load the kettle through a safety loader. Only small pieces of asphalt can be used so that they don't stack up under the loader and block it.

Warming Kettles

Warm the flue before bringing the flame up to operating pressure.

> **WARNING:** In winter, the asphalt can become solid and create a seal around the openings of the kettle. If that happens, the pressure in the kettle can build up.

Tankers

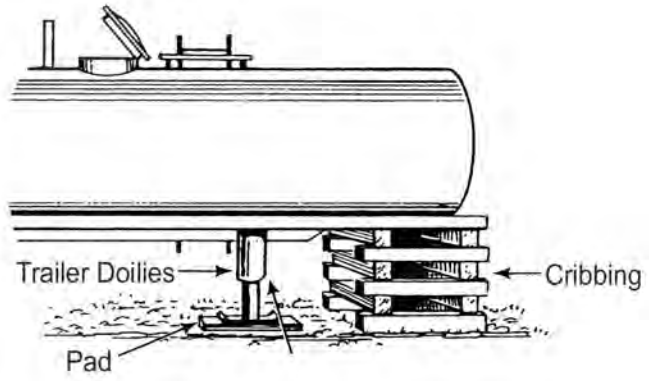
The driver is responsible for the safe operation of the tanker and for safe practices around the tanker and kettle.

Setup

Asphalt tankers should be positioned as level as possible and on firm ground. When a tanker is set up on a slope or is badly out of level, the heating tubes become exposed at the high end of the tank as asphalt is drawn off. The exposed tubes overheat and create a dangerous situation that could easily result in a fire or explosion.

Setting Up Tanker on Slopes Creates Ideal Conditions for Fires

To ensure that the tanker will be stable enough, support each of the trailer dollies on a pad resting on firm ground and provide extra support in the form of wood cribbing or jacks at the front of the trailer.



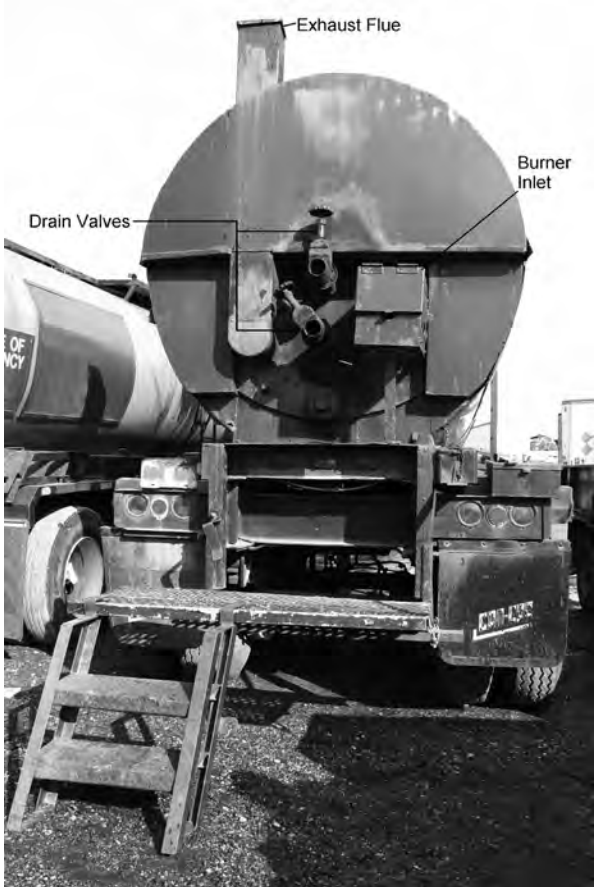
Tanker Cribbing

Operation

- Before firing the burner, open the exhaust stack covers. Close them when the burner is shut down to reduce heat loss.
- Never fire the burners unless the heating tubes are covered with material. Do not draw off material below the tops of the tubes while burners are ignited.
- If the draw-off valves are below the level of the heating tubes, be extremely careful to keep material above the level of the heating tubes while the burners are operating.
- When asphalt is being heated, the tank access cover should be slightly open to allow volatile gases to escape and the pressure to equalize. In the event of an explosion, the cover will act as a relief port.
- When heating cold material, regardless of the material level, lower the fuel pressure and bring the temperature up slowly until the pump is free. Then raise the pressure to normal.
- Do not operate burners at more than 138 kilopascals (20 psi).
- Do not exceed the manufacturer's recommended maximum temperature for materials. Temperatures above this level can ignite the vapours in the tank and cause a fire or explosion.
- Do not stand over the tanker access when filling an already heated empty tank. The vent pipe emits the volatile flammable vapours given off when asphalt is heated.
- The vent pipe must be open. If it becomes plugged, flammable vapours can build up to explosive levels inside the tank.
- Do not use an open flame on top of the tank at any time because it could ignite the fumes from the tank.
- If a vent pipe freezes, remove all piping and take it to a place far from the tanker for thawing.
- A common method for checking the asphalt level is to lower a measuring rod through the access. Use a solid rod rather than an open pipe, which will let hot asphalt splash up through its hollow core.
- Do not light a burner when it is near any flammable material.
- Turn off the burners and engines before refuelling. Let the burners cool.

- At night, secure the burner, the access cover, the kettle lid, the draw-off cock, and the fuel.
- When transferring asphalt from the tanker to the kettle, use a pipe, not a chute or trough.
- Always keep a fully charged 4A4OBC fire extinguisher handy.
- Follow all the tank manufacturer's operating and maintenance instructions.

NOTE: Kettle operators must monitor the kettles at all times when they are in operation.

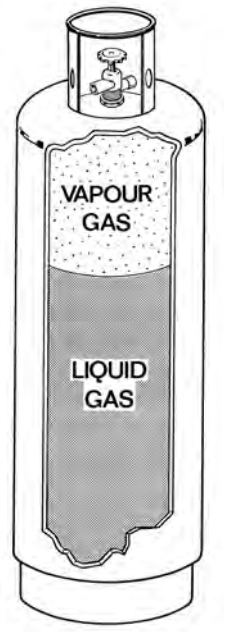


Tanker with Proper Access

17 Propane, Burners, and Torches

Propane tanks or cylinders are available in different sizes with different methods of fuel withdrawal (liquid or vapour). The liquid gas at the bottom of the tank must never come in contact with the relief valve.

When transporting, using, or storing cylinders, the cylinder relief valve must remain in contact with the vapour space.



Cutaway View of Vapour-Withdrawal Propane Cylinder

WARNING: Never connect a vapour-withdrawal propane cylinder to a liquid-propane appliance or vice-versa.

Training

All workers must be trained before handling or using propane on a jobsite.

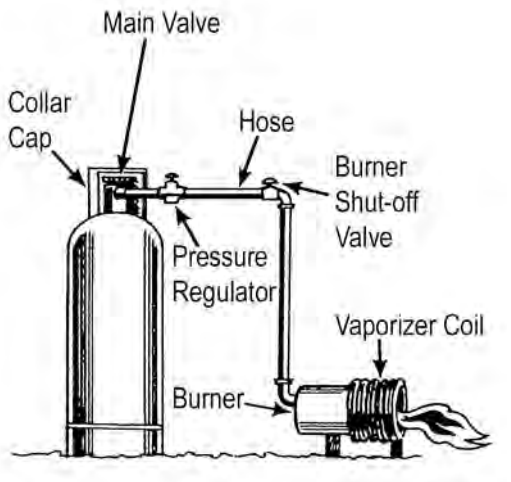
- You must have a record of training (ROT) recognized by the Technical Standards and Safety Authority (TSSA) before you can off-load, hook up, or light a propane-fired heater.
- This training must be updated every three years. IHSA offers a *Propane in Roofing* course.

General Propane Safety

A propane burner system consists of a fuel container designed for a specific type of withdrawal (liquid or vapour), a main container valve and collar cap, a pressure regulator, a pressure gauge, a burner shut-off valve, a fuel line or approved hose, and a burner assembly.

Containers for liquid withdrawal are equipped with a dip tube. Containers for vapour withdrawal have no dip tube, and only vaporous gas can be withdrawn.

NOTE: The burner should always be kept at least 3 m (10 ft) away from the tank.



Proper Propane Burner System

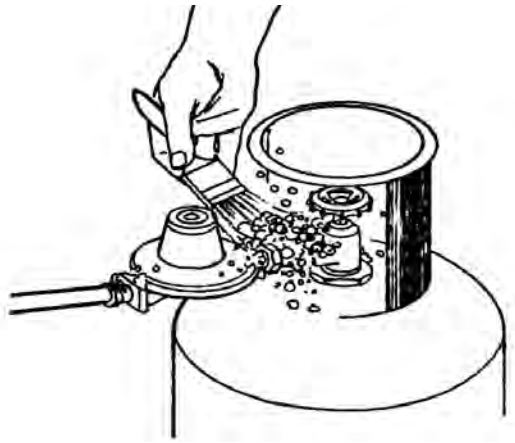
Precautions with Propane Equipment

- Make sure the hoses are in good condition and all connections have been tightened and soap tested by a qualified worker holding a propane certificate.
- Handle propane cylinders with care. When they are not being used, store empty and full cylinders in a designated location that is shaded, not close to flammable materials, and protected against damage and vandalism. Container valves must be closed tightly. Protective collars or caps must be in place.
- A cylinder inside a building must not be located near an exit, a stairway, or a place normally used or intended for evacuating the building.
- Cylinders must be connected and disconnected in a well-ventilated area. There must be no source of ignition within 3 m (10 ft) of the connection point.
- Never put propane containers—full or empty—below ground level unless it is absolutely necessary.
- Remember that propane is heavier than air. If there is a leak, it will seek the lowest possible level and collect in places such as trenches, excavations, and basements.
- Never heat a propane container.
- Never hoist a propane cylinder by its collar—use a hoisting carriage.
- Unless specifically designed for horizontal use, all cylinders must be transported, used, and stored in an upright position. The safety relief valve must be open to the vapour space above the liquid gas.

Upright Propane Tank Secured on Cart

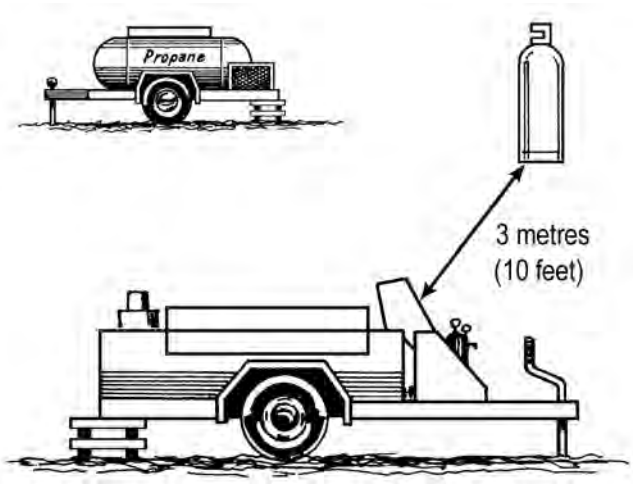
Detecting leaks

A propane burner system must be tested for leaks before being used. To detect the source of a leak, brush soapy water over the joint. If there is a leak, the gas supply must be turned off immediately at the container. Never use a flame to test for leaks.



Precautions with Propane Burners

- When a burner is lit, it must be at least 3 m (10 ft) away from any 45.4-kg (100-lb) propane cylinder and at least 7.6 m (25 ft) away from any larger propane tank.
- To light a burner, use only a flint sparker or igniter.
- Once a burner has been lit, never leave it unattended.
- Once a burner has been lit, never direct it towards any person or flammable object. There is a dangerous invisible extension of the flame that can cause a fire, considerable damage, and serious burns if a burner is handled carelessly.
- Never use an open flame to detect leaks in the propane system. This can cause serious fires and even explosions.
- To prevent the excess flow valve from closing too soon, open the container valve slowly until it is fully open. If an excess flow valve closes during normal operation, close the container valve immediately. Do not use the container until the supplier is notified and the problem is corrected.
- Equipment must be maintained and repaired only by specially trained persons.



Burner at Safe Distance from Cylinders and Large Tank

Precautions with Hand-Held Torches

Hand-held torches are used for many operations in the roofing industry, such as melting snow and ice, drying roof decks, and heat sealing.

- When you are using a hand-held torch inside a building, be sure there is proper ventilation.
- Never leave an ignited hand torch unattended.
- When an operation is finished, always shut off the container valve first. Allow the gas in the system to burn off. After the flame has gone out, shut off the torch control.
- Make sure the propane cylinder is properly secured and in an upright position.

- Be sure to use an approved high-pressure hose to connect the torch to the pressure regulator.
- Operate the torch at the manufacturer's recommended pressure.
- Never direct the flame from the torch onto or towards a propane cylinder.

Worker Using Hand-held Torch

Safety Checklist

- ☐ Before lighting any burner, have at least one fire extinguisher or the number required by the construction regulations.
- ☐ Equipment containing burners must never be towed or transported while a burner is in operation.
- ☐ Propane cylinders must always be stored, secured, and transported in an upright position and with the cylinder valve closed.
- ☐ Protective collars must be on cylinders at all times.
- ☐ A cylinder being used inside a building must not be located near an exit, stairway, or area normally used or intended for evacuating the building.
- ☐ Cylinders must be connected and disconnected in a well-ventilated place with no source of ignition within 3 m (10 ft) of the connection point.
- ☐ When a cylinder is not being used, the pressure regulator must be removed.
- ☐ Never force brass or bronze fittings to avoid stripping the thread.
- ☐ Always check hose and connections for damage and leaks before using equipment.
- ☐ Use a proper leak-check solution to check all joints for leaks. Never use a flame to check for leaks.
- ☐ All valves must be fully open when the system is in operation. The only thing regulating the flow of gas should be the pressure regulator.
- ☐ All valves must be closed when the burner is not in use.
- ☐ When an operation is finished, always shut off the container valve first. Allow the gas in the system to burn off. After the flame has gone out, shut off the torch control.
- ☐ Relief valves on cylinders must always point away from the burner.
- ☐ Never use a burner bigger than recommended for the piece of equipment. If you do, it will burn out the heating tubes, damage the quality of the asphalt, or cause a fire or explosion.
- ☐ Never light a burner while it is in the kettle or tanker.
- ☐ Never put a hose into the burner well of a kettle.

18 Night Roofing

Roofing work that is done at night is dangerous and is not recommended. However, it is popular with owners of non-residential buildings because it does not disrupt the building operations during regular business hours and people using the building are not bothered by noise or the smell of asphalt.

The main reasons that night roofing is dangerous are the following:

- Poor visibility at night
- Lack of alertness in night workers
- Electrical hazards from artificial lights
- Potential at certain times of the year for dew or frost, which can cause single-ply membranes to become dangerously slippery.

Poor Visibility

Roofing entails working at heights with molten asphalt and open flames, handling heavy materials, operating power equipment, and other high-risk activities. These hazards are compounded when working at night with poor visibility.

Alertness of Workers

Workers and employers should all be aware that workers who put in long hours at night tend to be less alert than those who work during the day. Therefore they are more prone to accidents.

There are two reasons for their lack of alertness:

1. A person's "body clock" can be disturbed by shift or night work.
2. Night workers may not be getting enough sleep.

Artificial Light

If work is to be done in the dark, it is essential to have adequate artificial lighting.

- Make sure there is enough light for workers to move around safely in the work area.
- Make sure the lights don't cast long shadows that hide the hazards from view.
- Make sure the lights don't cause temporary blindness by shining into the workers' eyes.

WARNING: No amount of temporary lighting can duplicate daylight conditions.

Housekeeping

With the lack of daylight, good housekeeping during night roofing is of the utmost importance.

- Make sure to have a proper site plan, and train workers on that plan.
- Pay special attention to keeping access ways, building edges, and roof openings clear.

For more information, see Chapter 7: "Planning and Housekeeping" (p. 7 - 1).

Electrical Hazards

- Temporary lighting must follow basic electrical safety principles.
  - Water and moisture, which are common in outdoor work, can create a serious electrical hazard and subject workers to electrical shock.
  - The equipment must be robust enough to withstand rough handling.
  - As roofing often involves the use of flammable materials and volatile fuels, the lighting equipment should be explosion-proof to prevent sparking or ignition of these materials.
- Use lights that are portable and lightweight, so they can be moved easily to where the work is being done.
- Make sure the cables supplying power do not pose a hazard from tripping or electric shock.
- Have backup lighting and generators on hand in case any of the equipment breaks down.

Temporary Lighting in Public Way Protection

Fall Prevention

At night, the risk of falls and injury, which are always present in roofing work, are much greater because of the darkness.

- Set up barricades around work areas to prevent workers from leaving the illuminated work area.
- Install guardrails wherever there is a risk of falling through openings and skylights.
- Erect guardrails, with their own lighting, to form runways between entrances, exits, and work areas.
- Entrances, exits, ladders, stairs, and hoist locations all require their own lighting.
- Attach reflective tape to all guardrails, roof edges, and perimeters to help the workers recognize possible hazards and unsafe places.
- It is advisable to have workers wear reflective clothing.

Wear Reflective Clothing at Night

Make sure your emergency response plan covers the challenges of night rescue. For sample rescue procedures from the uppermost work level at night, refer to the Emergency Procedures chapter in IHSA's *Construction Health and Safety Manual* (M029 2019 ed).

19 Working Alone

Sometimes work may be carried out by a roofer who is working alone, working in an area that is separate from other workers, or working late at night. A worker in those situations may become injured, trapped, or otherwise incapacitated and not be able to call for help.

Factors that can make it difficult for an injured worker to get help are:

- The worker is unconscious or unable to move.
- The worker cannot reach a phone, or the means of communication is not working.
- The worker is unable to move and is beyond the sight or hearing range of other workers.
- No one is aware of the situation because the worker does not have a scheduled time for calling in.
- A call-in schedule has been established, but the interval between calls is too long.
- The location is remote and emergency services cannot respond quickly or must come from far away. They may also encounter difficulties locating the jobsite or the worker.

Any delay in rescuing an injured worker puts them at risk of serious complications or even death. It is not recommended that a roofer work alone. However, if that is unavoidable, there must be a reliable communication system between the roofer and someone who can help in an emergency.

Responsibilities

Under the OHSA, employers and supervisors have a general duty to take every precaution reasonable in the circumstances for the protection of a worker. This would include help and support for personnel working alone.

The construction regulation requires the constructor to establish and implement written procedures to be followed in the event of an emergency (O.Reg. 213/91, s.17). The constructor also has a duty to ensure that every worker on a project has ready access to a telephone, two-way radio, or other system of two-way communication in the event of an emergency.

Make sure your company has a health and safety policy and procedure to protect employees who may have to work alone. Also make sure the emergency response plan includes procedures to cover working alone.

Communication

Communication is crucial. At regular intervals, someone should check on the worker or the worker should report to a designated person. Where hazard exposure is high, intervals should be kept short.

The worker should make every reasonable effort to advise the dispatcher, on-duty person, answering service, supervisor and/or client of job progress, expected time of completion, actual time of completion, and departure from the site.

When using an answering service, the general procedure involves phoning in regularly. If the worker fails to report at one of the designated times, the answering service phones the employer, who checks on the worker.

The employer or supervisor must ensure that:

- A method of checking in with the worker has been established.
- Check-in intervals are clearly understood by both parties.
- The designated contact person is aware of the work schedule.
- Communication equipment is in good working order.
- No obstructions or interference may block radio or phone communications.
- The person working alone is:
  - aware of real and potential hazards in the area, including the potential for violent confrontations
  - trained to recognize and control hazards
  - provided with procedures and equipment to do the job safely.

All safety and work-related procedures should be reviewed with personnel before they work alone. Local emergency services should be identified and contacted to confirm phone numbers and availability. These services may be provided by on-site emergency response personnel or through local municipal services.

Safe Work Procedures

Here are some safe work procedures for workers to follow when working alone:

- Upon arrival at a site, inform your employer (or an alternate contact) of your location, your intended start time, the time of your next call-in, and the estimated time for completing the work. Remember to inform your contact when you have finished work and are leaving the site.
- Review any emergency procedures in place at the worksite and make sure they line up with your employer's procedures. Some locations may have site control procedures to record any information that may help protect worker safety (site entry and exit, who is working on site, expected duration of the work, contact information, etc.).
- Be sure emergency response personnel on and off the site will be able to locate you in order to carry out an emergency rescue.
- Local emergency personnel may not be trained or capable of providing immediate assistance. Identify if any special equipment and material will be required. For example, make sure local rescue will be able to access the rooftop.
- Ensure that the emergency response procedure will apply to all possible emergencies and that rescue personnel will be able to respond. In remote locations or late at night, rescue services may be limited.
- Identify who is available to provide assistance at the site and how you will communicate with that person in case of an emergency.

20 Vehicle Safety and TDG

Getting workers and materials to the worksite can sometimes present health and safety hazards. While these hazards are often overlooked, taking just a few precautions can make a big difference.

This chapter will deal with vehicle safety and the transportation of dangerous goods (TDG).

Know the law

Vehicle and trailer safety is governed by federal regulations as well as provincial regulations under the *Highway Traffic Act* (see O. Reg. 199/07 and 611).

Vehicles

Before each shift, do a basic vehicle inspection. The following "daily circle check" is a good procedure.

Check the following:

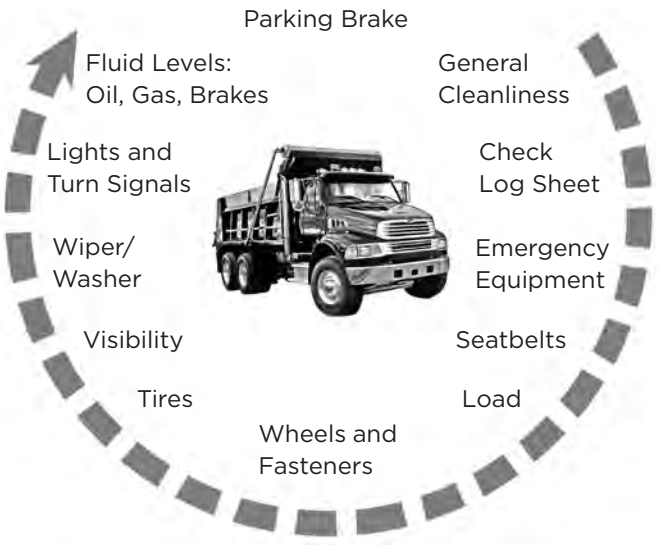
- ☐ Parking brake—adequate to hold vehicle.
- ☐ Fluid levels—oil, gas, and brakes. Check for leaks.
- ☐ Lights and turn signals—functioning.
- ☐ Visibility—mirrors properly adjusted, windows clean and intact.
- ☐ Wiper and washer—functioning.
- ☐ Tires—pressure, depth of tread, damage.
- ☐ Wheels and fasteners—defects in rim, loose or missing fasteners.
- ☐ Emergency equipment—install and inspect as required by law or company policy.
- ☐ Fire extinguisher—vehicle equipped with a fully charged dry-chemical fire extinguisher (4A4OBC).
- ☐ First aid kit—fully stocked
- ☐ Load—secure and evenly distributed.
- ☐ Driver's line of sight and mirror—not obstructed by material or equipment.
- ☐ Everything securely in place. (Hard hats and other equipment can become flying objects in an accident.)

NOTE: Record any defects, and report them to your supervisor immediately.

Trailers

- Before using a trailer, be sure it is in safe operating condition. Inspect the following:
  - lights
  - tires
  - brakes
  - bearings
  - safety chains
  - hitch.
- Use the right class of trailer hitch on your vehicle:
  - Class I—up to 2,000 lb
  - Class II—up to 3,500 lb
  - Class III—up to 5,000 lb
  - Class IV—up to 10,000 lb
- A trailer requires two separate means of attachment to the vehicle. A typical arrangement incorporates a ball hitch with two safety chains. The capacity of each chain should be equal to the gross weight of the trailer and should cross under the tongue to connect to the hitch.
- Loose objects must be covered with a tarp. All loads on trucks and trailers must be secured or placed so that no part of the load can become dislodged or fall off the vehicle.
- Anchor points, rope, and slings used for tie-downs must be in good condition. Inspect them before each use.
- Check the Commercial Motor Vehicle Inspections regulation (O. Reg. 199/07) for pre-trip and annual safety evaluation requirements when using trailers.

DAILY CIRCLE CHECK



Transportation of Dangerous Goods (TDG)

The *Transportation of Dangerous Goods Act* (TDG Act) applies to roofing contractors whenever they are transporting hazardous material on a road or highway. It is the obligation of roofing contractors to understand the requirements of this Act.

Under the TDG Act, the driver and owner of the vehicle also have responsibilities and obligations. For more information, contact IHSA, which provides training, or a local Ministry of Transportation office.

If you are transporting more than 150 kg (300 lb) of dangerous goods, you must be specially trained (TDG Act).

Read the safety data sheet (SDS) of each material you are transporting. It may contain specific information about transporting that material.

NOTE: A driver who is transporting propane must also follow the Propane Storage and Handling Code (see O. Reg. 223/01 under the *Technical Standards and Handling Act*).

Musculoskeletal Hazards and Controls

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LOW-SLOPE ROOFING

Musculoskeletal disorders (MSDs), such as chronic back pain or shoulder problems, often take time to develop. Forceful exertion, awkward positions, hand-arm and whole-body vibration, contact stress, and repetitive tasks can add up over time to produce an MSD.

This profile can help you identify and control MSD hazards in your job. We recommend that you add the best practices outlined here to your company's health and safety program. The hazards in a particular job, however, may be different than the ones on this profile, so evaluate the risks of your particular activities.

When putting MSD controls in place, consider the following ergonomic principles:

1. **Use handling equipment when possible.** The best way to prevent an MSD is to eliminate or reduce the frequency of lifting, carrying, pushing, and pulling. Use material-handling equipment such as carts, dollies, pallet jacks, or lift trucks.
2. **Don't lift a load from the floor.** Lifting from the floor or from below standing knuckle height can put severe stress on your back and reduce your lifting capacity. To avoid this, store objects above standing knuckle level and below standing shoulder level.
3. **Avoid working on the floor.** Constantly working on the floor can result in injuries to your back, hips, and knees because you usually have to kneel and bend forward. When possible, raise the work height by using a workbench.
4. **Minimize work above your shoulder.** High lifting or constantly reaching above your shoulders can be harmful. Most of the work is being done by the smaller muscles in your shoulders and arms instead of by the larger muscles in your back and legs. When your arms are raised, the muscles fatigue more quickly because there is less blood flow and there is a greater chance you could drop the object.
5. **Get help with large loads or split them into smaller loads.** Get help from a co-worker if a load is too heavy to handle on your own. If possible, split the load into smaller loads. Making more trips with small loads puts less stress on your back than making fewer trips with large loads.
6. **Practise good housekeeping.** Pick up debris and garbage to prevent trips, slips, and falls. A clean worksite also allows you to get closer to your work and equipment.
7. **Conduct a Job Safety Analysis (JSA).** Actively assess the job tasks and implement MSD controls before starting work to avoid overexertion and awkward positions.
8. **Perform stretching and warm-up exercises before starting work.** This not only prevents MSDs but also promotes general good health. Use IHSA's *Before You Start Work Exercises Card* (V012).

Photocopy this profile and distribute it as widely as possible!

Tasks	What can happen (Hazards/Risks)	Potential Controls
Strips and removes roofing materials from roof cavity	• Lower back and shoulder injuries • Overexertion injuries from manually handling old roofing materials and removing old battens or roof frames	• Use upright scraping tools whenever possible. These tools give you mechanical leverage and reduce the need to bend forward. • Use mechanical dollies, wheelbarrows/carts, or buggies to carry roofing materials when possible. • Use mechanical lifting, cutting, and removal equipment when possible. • Use shovels to lift small items into a wheelbarrow or cart.
Applies built-up roofing components • Applies vapour barriers and air barriers • Installs insulation • Installs protection board • Installs drains, vents, and roof fixtures • Applies ballast and protective surfaces • Fits roof accessories, (e.g., barge and ridge caps)	• Repetitive forward bending from using a screw gun or nail gun to secure battens, vapour barrier, protection board, and insulation • Knee and back injuries due to squatting and kneeling while working on the roof (e.g., while cutting roof materials such as battens, insulation, protection board, or barriers) • Overexertion due to manually placing materials onto the roof such as lifting roof sheets into position, moving vapour barriers, handling long metal roof battens, and lifting accessories into position • Bending forward to install accessories	• Consider using upright automatic-feeding screw guns. This mechanical tool allows workers to stand upright instead of having to bend forward. • Avoid working on the roof surface whenever possible. For example, cut roof materials on a mobile table. • Use mechanical handling machines, such as powered buggies, when moving materials around the work area. • Use mechanical equipment or get help from another worker if one piece of material is greater than what you can safely handle. Consider the weight of the item, the lifting location, and your posture. • For roofing membranes greater than two metres, more than one person should lift long lengths of capping or other accessories. • Use the proper lifting techniques: - Lift materials with your legs (do not bend over and lift with your back). - Keep the load close to your body. • Use mechanical devices to spread gravel when possible. • Use powered mechanical caulking equipment when possible. • Arrange material to minimize the amount you have to twist and bend. • Allow workers to choose between various mop sizes. • Break up blocks into three or more pieces. • Roll asphalt kegs instead of lifting them from a pallet. • Purchase smaller asphalt blocks to reduce weight. • Use an asphalt tanker truck instead of a kettle.

Tasks	What can happen (Hazards/Risks)	Potential Controls
Applies membranes • Applies membranes using hot process • Applies membranes using torched-on method • Applies membranes using hot-air welding • Applies membranes using cold process • Applies membranes using mechanical fasteners • Applies loose-laid membranes • Installs membrane flashings • Installs liquid applied roofing membrane	• Overexertion injuries from manually handling propane and torches • Lower back and shoulder injuries from lifting and carrying roofing membranes	• Use mechanical equipment or get help from another worker if one piece of material is greater than what you can safely handle. Consider the weight of the item, the lifting location, and your posture. • Use the proper lifting techniques: - Lift materials with your legs (do not bend over and lift with your back). - Keep the load close to your body. See the chapter on "Back Care" in IHSA's *Construction Health and Safety Manual* (M029).

NOTE: The hazards and controls described in this chart are examples and do not cover all possible situations.

Don't forget about other hazards at your workplace. For more information, visit ihsa.ca

A publication of the Roofer Trade Labour-Management Health and Safety Committee
in partnership with the Infrastructure Health & Safety Association
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September 2019 **W311**

HEALTH & SAFETY ADVISORY

Safe Guarding Around Powered Trolley Hoists

A large part of roofing work involves moving supplies and equipment with hoisting systems. The most popular materials-handling system for this task is a conventional powered trolley hoist. Not only is it a low-cost option but also it can work in areas where space is so limited that a crane could not be used to lift equipment onto the roof.

Hazard

Workers who operate a trolley hoist must handle two lever clutches and a brake system. Critical injuries and damage to property and roofing equipment can occur if the hoist system or hoist drum are not set up or designed properly.

Crush or pinch injuries

Crush or pinch injuries can occur if the cable drums of the trolley are not properly guarded (see Figure 1). A crush or pinch injury occurs when the body or a part of the body is trapped, pinched, or jammed under or between the cables and the rotating cylinder. The high pressure of the contact between the trolley drum and cables can damage skin, muscles, nerves, or bones.

Poor design of the trolley hoist (e.g., improper guarding around the cable drum) can cause fingers, hands, and lower arms to be drawn into the rotating cylinder. The hoist operator or those working near the hoist can also be drawn in between the cable and the hoist drum if their hands or clothes are in contact with the rotating cables or drum.

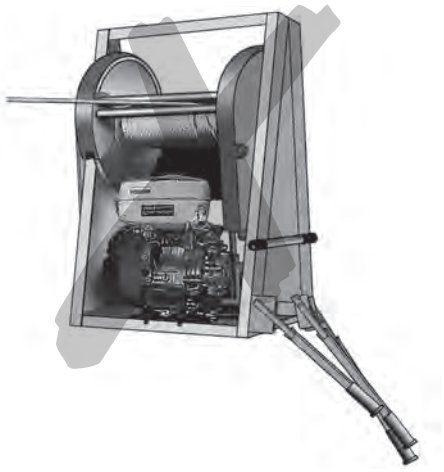

Figure 1: A trolley hoist with no guard cover around the cable drum can cause crush or pinch injuries

Legislative Requirements

The employer has a legal duty to identify this hazard to workers and their supervisors as per the following requirement under the *Occupational Health and Safety Act*:

> *An employer shall acquaint a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent.* (OHSA, s.25(2)(d))

MOL inspectors will actively enforce proper guarding on trolley hoists to prevent crush or pinch injuries to workers.

In addition, the Construction Projects regulation requires guards or fencing over the hoist to prevent workers from coming into contact with the cable as it wraps around the hoist drum.

In these situations, guards are used to prevent workers from being exposed to hazards from moving parts on the machines:

> *Every gear, pulley, belt, chain, shaft, flywheel, saw and other mechanically-operated part of a machine to which a worker has access shall be guarded or fenced so that it will not endanger a worker.* (O. Reg. 213/91, s.109)

Protective Measures

Installing a guard in front of the cable drum area can prevent the operator and workers near the machines from being drawn into the wheel drum area. Barrier guards around the cable drum area must have the following features:

- They must be constructed to withstand operational forces and environmental conditions.
- They must be free of sharp edges and projections and not create any additional hazards themselves.
- They must be a metal mesh or Plexiglas shield that covers the entire drum area when the machine is in operation. This will allow the operator to observe the cable as it wraps around the drum. (See Figure 2.)
- They must have the ability to be bolted shut, locked shut with a key, or interlocked when the machine is in operation.
- The cable wire opening cannot be more than 49 mm (1.875") in diameter to prevent fingers and hands from being drawn into the machine when in operation (as per CSA Z432: *Safeguarding of Machinery*).

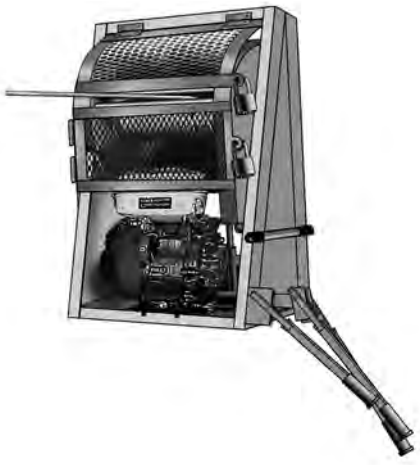

Figure 2: Guarding around the cable wire drum can be metal mesh or Plexiglas

- Covers must have a means of secure attachment (i.e., a latch) and allow access to the machine when it's not in operation. For example, Figure 3 shows a metal mesh guard cover that is hinged on the opposite side from the operator, which allows them to access the fuel tank and do maintenance on the spool and cables when the equipment is not in operation. The latch is on the same side as the operator for easy reach. Note the two metal rollers near the top, which makes winding the cable easier.

Figure 3: Cover with latch on the same side as the operator and hinge on opposite side

Additional Resources

For more information on the hoist system setup and other requirements by the Ontario Ministry of Labour (MOL), refer to the following documents:

1. MOL Alert: ***Unguarded Rotating Trolley Track Hoist Drums*** – contains additional solutions to protect operators and those working near trolley hoists.

   labour.gov.on.ca/english/hs/pubs/alerts/c26.php

2. IHSA's ***Low-Slope Roofing Health and Safety Manual*** (M070)

A publication of the Roofer Trade Labour-Management Health and Safety Committee in partnership with the Infrastructure Health & Safety Association

September 2019

W457