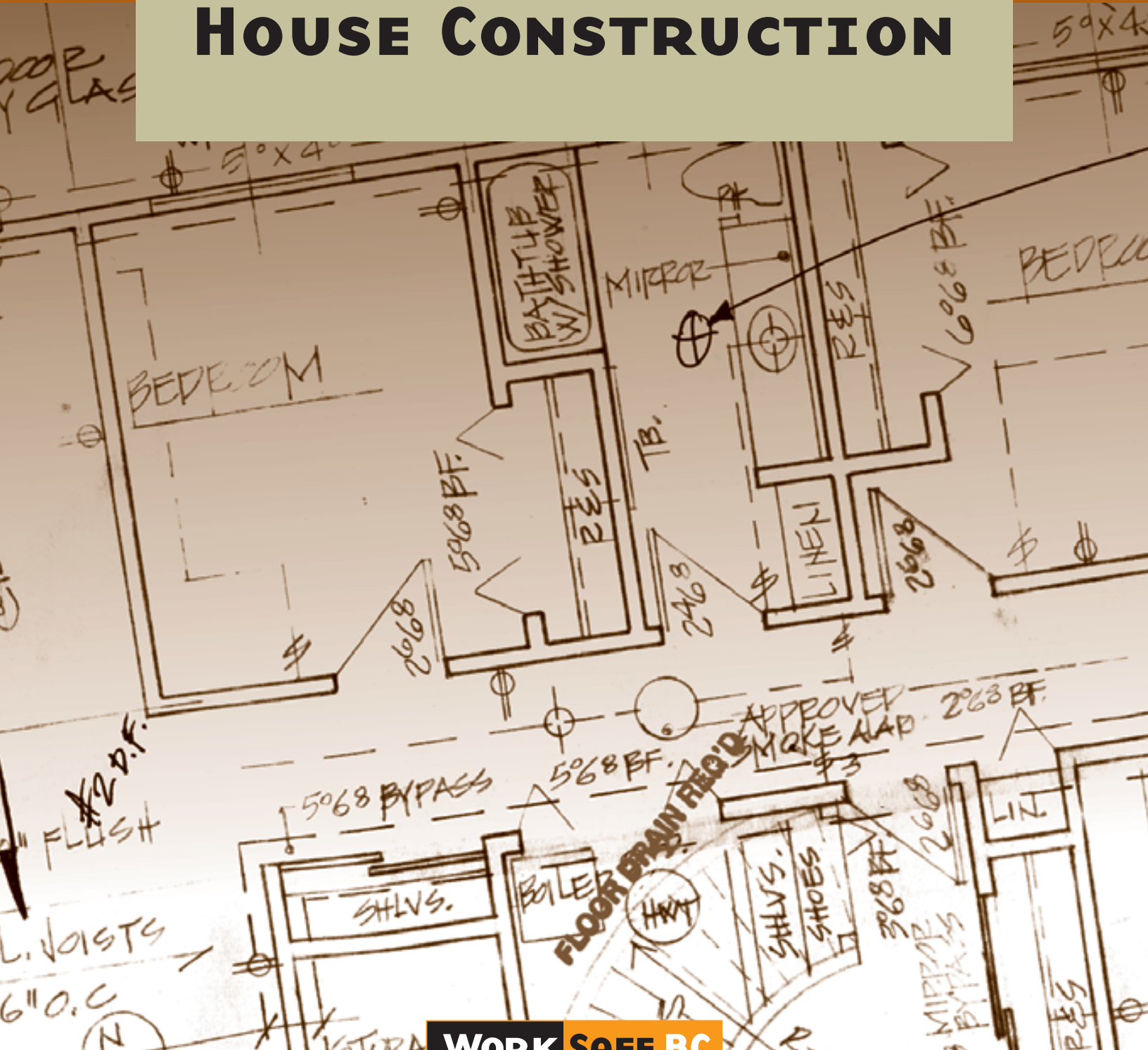


SAFE WORK PRACTICES FOR HOUSE CONSTRUCTION



WORK SAFE BC

WORKING TO MAKE A DIFFERENCE
worksafebc.com

WORKERS' COMPENSATION BOARD OF B.C.

About WorkSafeBC

WorkSafeBC (the Workers' Compensation Board) is an independent provincial statutory agency governed by a Board of Directors. It is funded by insurance premiums paid by registered employers and by investment returns. In administering the *Workers Compensation Act*, WorkSafeBC remains separate and distinct from government; however, it is accountable to the public through government in its role of protecting and maintaining the overall well-being of the workers' compensation system.

WorkSafeBC was born out of a compromise between B.C.'s workers and employers in 1917 where workers gave up the right to sue their employers or fellow workers for injuries on the job in return for a no-fault insurance program fully paid for by employers. WorkSafeBC is committed to a safe and healthy workplace, and to providing return-to-work rehabilitation and legislated compensation benefits to workers injured as a result of their employment.

WorkSafeBC Prevention Information Line

The WorkSafeBC Prevention Information Line can answer your questions about workplace health and safety, worker and employer responsibilities, and reporting a workplace accident or incident. The Prevention Information Line accepts anonymous calls.

Phone 604 276-3100 in the Lower Mainland, or call 1 888 621-7233 (621-SAFE) toll-free in British Columbia.

To report after-hours and weekend accidents and emergencies, call 604 273-7711 in the Lower Mainland, or call 1 866 922-4357 (WCB-HELP) toll-free in British Columbia.

SAFE WORK PRACTICES FOR HOUSE CONSTRUCTION



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WorkSafeBC Publications

Many publications are available on the WorkSafeBC web site. The Occupational Health and Safety Regulation and associated policies and guidelines, as well as excerpts and summaries of the *Workers Compensation Act*, are also available on the web site: WorkSafeBC.com

Some publications are also available for purchase in print:

Phone: 604 232-9704
Toll-free phone: 1 866 319-9704
Fax: 604 232-9703
Toll-free fax: 1 888 232-9714
Online ordering: WorkSafeBC.com and click on Publications;
follow the links for ordering

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2005 Edition

Library and Archives Canada Cataloguing in Publication Data

Main entry under title:

Safe work practices for house construction. -- [1998] -

Irregular.

"WorkSafe."

ISSN 1712-6681 = Safe work practices for house
construction

1. Building - British Columbia - Safety measures -
Periodicals. 2. House construction - British Columbia -
Safety measures - Periodicals. 3. Building - Safety
measures - Periodicals. 4. House construction - Safety
measures - Periodicals. 5. Construction industry -
Safety measures - Periodicals. I. Workers' Compensation
Board of British Columbia.

TH443.S23

690'.22

C98-960025-4

Introduction

This manual was developed for house builders, framers, scaffold users, various trades, and home owners. It provides general information on the safety requirements for the various phases of house construction.

This manual does not replace the Occupational Health and Safety Regulation. It is a tool to help workers and employers in the house-building industry understand how to develop, maintain, and enforce safe work practices and procedures in compliance with the Regulation.

The information in this manual is organized to loosely follow the steps in building a house. Not all aspects of house building are covered; rather, the manual focuses on key areas where the risk of injury can be reduced.

Other publications that may be of interest to house builders can be found at WorkSafeBC.com. Visit the Health and Safety Centre and choose Construction under Industry Centres.

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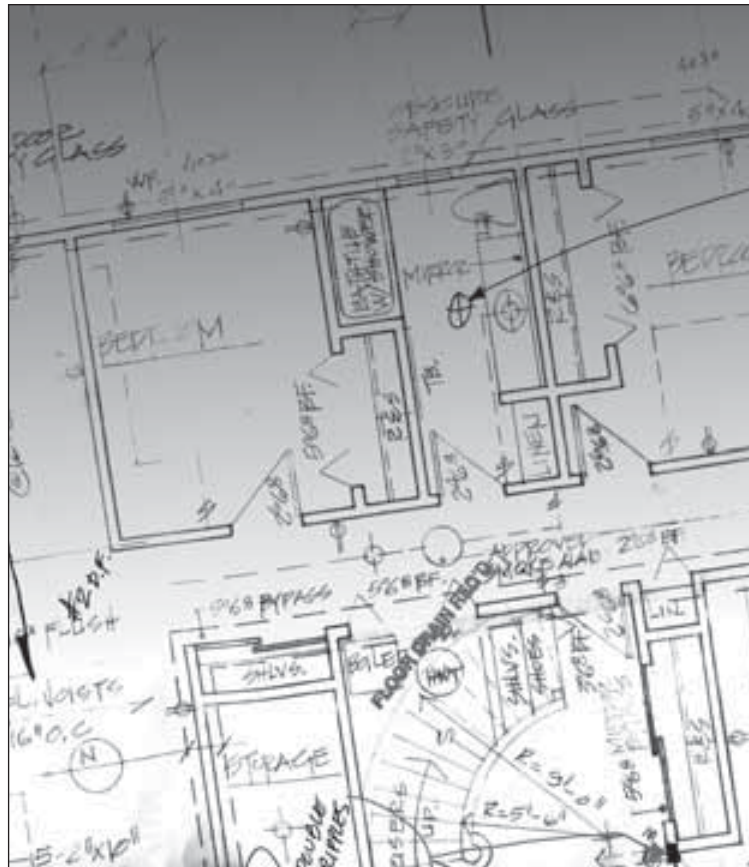
PRE-CONSTRUCTION CONSIDERATIONS

Planning and scheduling

It makes good business sense to prevent losses (including financial, time, equipment, materials, and human suffering) caused by accidents. To accomplish this, carefully plan and schedule all work activities before construction begins.

Accidents may have many causes, including:

- Lack of planning and scheduling
- Inadequate or ineffective worker training
- Poor communication



A good plan is more than just a piece of paper.

Housekeeping and on-site safety

Good housekeeping is key in maintaining a safe, productive building project. It's important to maintain good housekeeping throughout all phases of construction.

- Floors, platforms, stairs, and walkways must be maintained in good repair and kept free of slipping and tripping hazards.
- Waste materials and spills must not be allowed to accumulate in working areas. An ongoing program of waste disposal must be maintained.
- Work areas must be well lit.
- Material or equipment must be placed, stacked, or stored so it will not cause injury to workers.

The area within and surrounding the construction site can be very hazardous to workers if debris is allowed to accumulate.

- Use a waste bin to prevent accumulations of rubbish.
- Ensure there are no protruding nails on loose or fixed materials.
- Use danger or caution tape where open trenches or excavations could present a hazard.
- Ensure all ground areas are firm and level where scaffolding or ladders are to be placed.



Poor housekeeping can be a source of injury.

Basic checklist

Most house construction projects require a Construction Notice of Project (NOPC) to be sent to WorkSafeBC. To order the appropriate forms call WorkSafeBC at 604 276-3100 in the Lower Mainland or 1 888 621-7233 toll free within B.C.

Has the required first aid been arranged?

- ☐ Supplies
- ☐ Equipment
- ☐ Attendant

Is the current regulation on site or available to all workers?

- ☐ Occupational Health and Safety Regulation

Have the following underground services been located and identified?

- ☐ Water
- ☐ Gas
- ☐ Power lines
- ☐ Telephone lines
- ☐ Other

If demolition or land clearing is needed:

- ☐ Have the following services been disconnected at the property line?
 - Electrical, Water, Gas
- ☐ Has it been determined if hazardous materials (such as those containing asbestos) are present at the demolition site?
 - If so, have steps and precautions for safe removal been arranged?
- ☐ Are qualified people overseeing the removal of trees?
 - Are non-essential workers clear of the area?
- ☐ Have the sub-trades been informed of the location and dangers of underground services?

For overhead high-voltage power lines:

- ☐ Have they been identified?
- ☐ Has the voltage been determined?
- ☐ Is guarding of lines required?

Contact your local electrical authority for this information.

-
- ☐ Is a form 30M33 required?
 - ☐ Can deliveries with cranes and concrete pumper trucks be made safely outside the limits of approach to any high-voltage lines or transformers?

For excavations greater than 1.2 m (4 ft.) deep:

- ☐ Are the sides sloped to a safe angle? (3 horizontal to 4 vertical) or
- ☐ Is the excavation shored according to WCB requirements? or
- ☐ Is there documentation available on site from a registered professional engineer stating it is safe for workers to enter the excavation?

If there are suspended slabs and stairs, or foundation walls higher than 3.6 m (12 ft.):

- ☐ Are there formwork drawings available?

Fall protection requirements:

- ☐ Are there areas that will require guardrails? If so, where?

- ☐ Are there areas greater than 3 m (10 ft.) above grade where workers will require fall restraint? If so, where?

- ☐ Are there areas greater than 3 m (10 ft.) above grade where workers will require fall arrest? If so, where?

- ☐ Is a fall protection plan required? If so, what equipment is required?

- ☐ Have workers been trained in all aspects of the fall protection plan?
- ☐ Are there stairs requiring handrails?
- ☐ Are there roof or floor openings that need to be covered or guarded?

Are written safe work procedures in place for:

- ☐ Emergency phone numbers: gas, hydro, telephone, fire, ambulance, etc.
- ☐ Emergency evacuation
- ☐ Fall protection
- ☐ Lockout (if required)
- ☐ Other _____

Orientation of all sub-contractors and their workers:

- ☐ Is there an orientation plan developed for this site?

Asbestos removal

Most workers who have died from over-exposure to asbestos fibres have been in the construction trades.

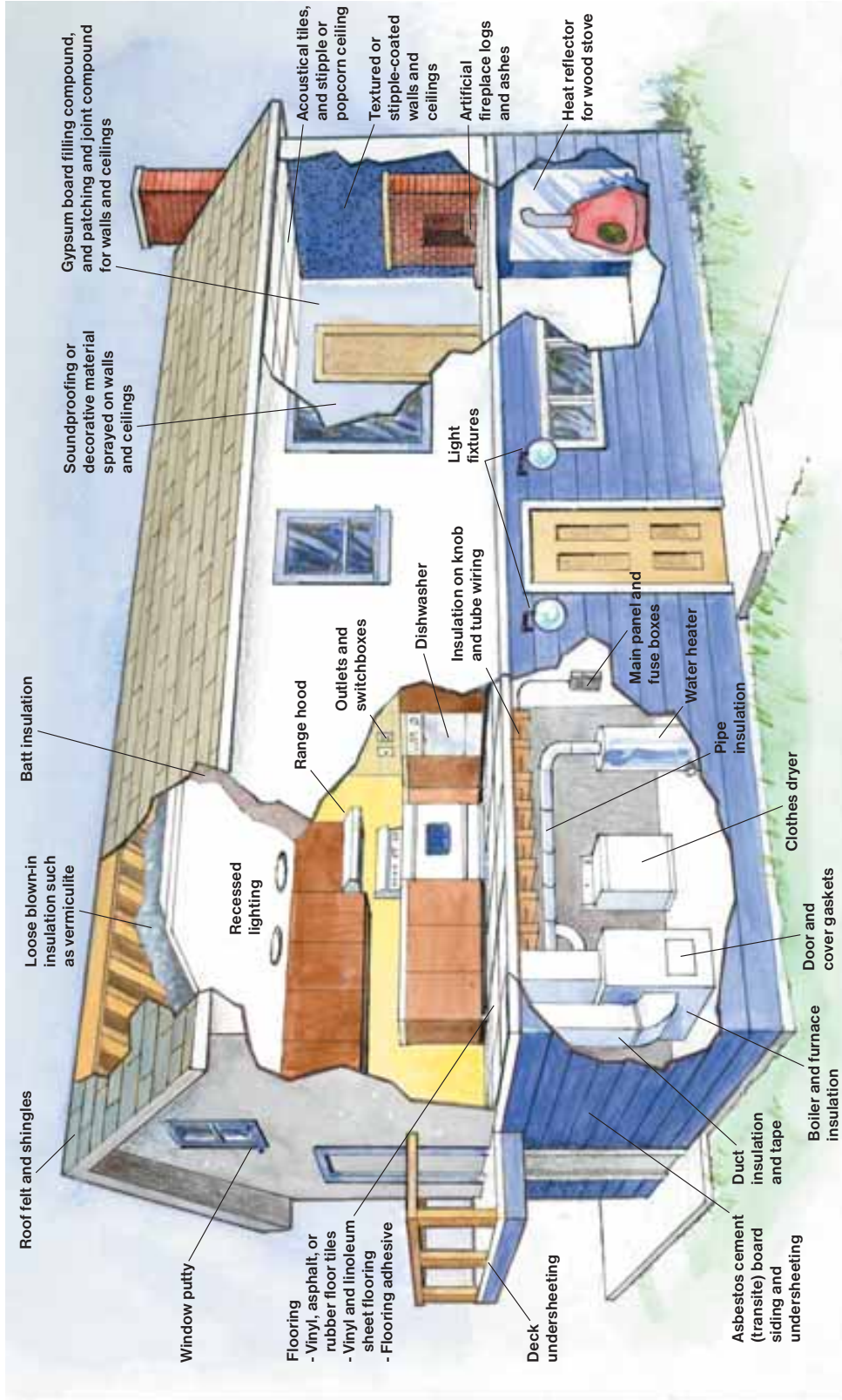
Until 1978, there were over 3000 products containing asbestos used in house construction. When renovating or demolishing older homes, there is a high probability of encountering asbestos-containing materials. Asbestos-containing materials that were once commonly used in residential construction are shown in the following illustration.

Exposure to asbestos fibres may result in asbestosis, lung cancer, or mesothelioma (cancer affecting the lining of the chest or abdominal cavity).

Employers and owner/builders are responsible for determining if materials containing asbestos are present at the job site before work begins. If these materials are found, they must be removed and disposed of by trained and qualified workers before renovation or demolition work begins.

If, during work activities, materials are found to contain asbestos — stop work immediately! Have trained, qualified workers remove this material before resuming work. (Refer to WorkSafeBC guideline: G68 Procedures for abatement of asbestos-containing material during house and building demolition/renovation.)

Possible sources of asbestos



These products may contain asbestos, depending on the age of the building and the materials used to manufacture the product.

Electrical power lines

Every year in B.C., some 100 injuries from electrical contacts result in wage-loss claims (including deaths) to the workers' compensation system.

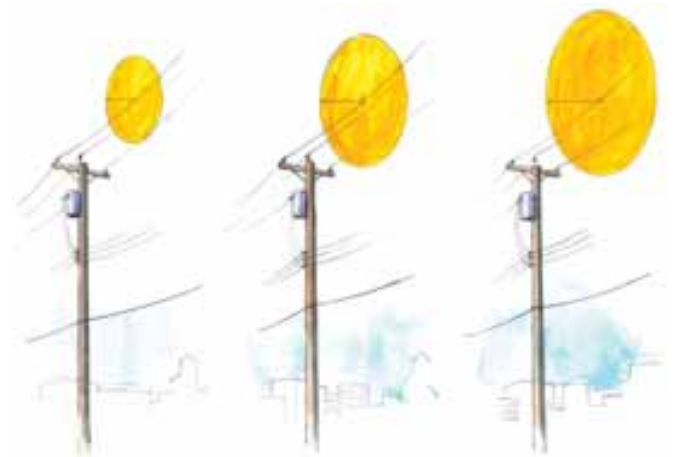
Overhead high-voltage electricity

Builders must identify the location and voltage of all overhead electrical conductors at a worksite. Remember to count transformers as conductors.

- During land clearing there may be a danger of trees being felled or pushed into overhead power lines.
- When any work activity takes place near energized overhead high-voltage lines, the following procedures must be followed:
- Determine what activities may take place in proximity to overhead high-voltage lines.
- Determine the voltage of the overhead lines through the authority controlling the system, for example, B.C. Hydro.
- Ensure that the following minimum clearance can be maintained at all times:

Minimum distances

Voltage (Phase to Phase)	Minimum Distance	
	(Metres)	(Feet)
751 V to 75 kV	3	10
Over 75 kV to 250 kV	4.5	15
Over 250 kV to 550 kV	6	20



- Do not use a tape measure or stick to physically measure the distance from an energized power line. Estimate the distance from the ground and, if in doubt, provide for more clearance.

If the minimum distance from the electrical conductor cannot be maintained, and movement by a worker or equipment may result in entering these minimum distances:

- STOP work immediately.
- Call the power authority controlling the electrical system and arrange for a worksite meeting to decide whether the energized electrical conductors can be:
 - De-energized
 - Effectively guarded
 - Displaced or rerouted

-
- Get assurance in writing (form 30M33) from the power authority indicating which of the three actions they will take and when it will be done. A form 30M33 is available from the local electrical utility, or any WorkSafeBC office (see the end of this book for a listing of WorkSafeBC offices).
 - Keep written assurances on the worksite and inform all workers who will be directly affected by the power authority actions.
 - Designate a qualified safety-watcher who can monitor equipment and material movement and give an instant STOP signal to the equipment operator when the equipment or load is too close to the electrical conductor.
 - Make sure equipment, work tools, or loads do NOT contact the electrical guarding.

In the event of contact, equipment operators and workers on the site must be aware of the possible energized ground around the machine and use extreme caution. Once part of a machine makes contact with a live power line, anything in contact with the machine will be energized for some distance around the machine, especially the ground around it. The point or points where the electrical flow reaches the ground will have the highest voltage, which drops off gradually as you move further away. This entire area of energized ground is the danger zone. Caution: wet ground will make the danger zone much larger and safe escape may be more difficult.

- *If you are on the machine* when it makes contact and you are not in danger, stay on the machine. If you are in danger, then leave by keeping your feet together and making a short

jump from the machine. The goal is to ensure that your entire body clears the machine and that you land on your feet without stumbling. If possible, stand still without touching the machine and keep your feet together until someone turns off the power.

- *If you are near the machine* and possibly within the danger zone, do not move. Stay where you are until someone turns off the power.
- *If you must move away* from the area, hop or shuffle away without moving your feet more than a couple of inches at a time. Keep your feet together to ensure that you do not straddle two zones with different voltages that would allow the electrical flow to take a new path (your body). Once you are well out of the danger zone, warn others to stay out of the danger zone or leave someone to guard the area, and then contact the power authority to shut off the power.

Overhead low-voltage electricity

Many workers are injured from contacting energized low-voltage wires (750 volts or less). Generally, workers suffer burns and physical injuries from shock. Employers must develop safe work procedures for working near low-voltage wires. There is no established minimum distance for working around low-voltage electricity.

Underground electrical hazards

- Driving ground rods or any other long metal objects into the ground can be especially dangerous around buried lines. Always check the cable location with your local power authority before starting.



- Fence post holes may be deep enough to reach underground power lines. Make sure you know the location of any underground cables before digging your holes.
- Pay attention to “Danger – High Voltage” signs. They mean that high-voltage equipment is enclosed inside and that everyone must keep clear.
- Before trenching, find out if there are any buried cables in the area and precisely where they are located.



The temporary supply box used during construction can be an electrical hazard. It consists of several outlets used by several sub-contractors. It is important that the temporary supply box is under strict control and has a lock-up cover to prevent tampering by others.



Temporary lighting needs special attention to ensure that wires are not trapped in doorways, where the wire could be pinched and the protective shield damaged. Replace any missing or burned-out bulbs to ensure there are no exposed connections and that the level of lighting is adequate for safe working conditions.



Do not hold on to metal water pipes or other grounded conductors when using electric power tools. A damaged cord or defective tool could make you part of the circuit, causing a shock or electrocution.

[illegible]

Basic personal protective equipment and clothing

All workers must equip themselves with suitable clothing, shirts, and long pants for protection against both the weather and workplace hazards. Unless otherwise agreed upon, workers are also responsible for providing their own work gloves, safety headgear, and safety footwear. However, if a product requires specified gloves to protect the user against hand injuries such as slivers and cuts, the employer must provide those gloves.

Employers are responsible for providing and enforcing the use of personal protective clothing and equipment. This includes fall, respiratory, eye, and hearing protection and any other specialized protective equipment required by the Occupational Health and Safety Regulation. Employers need to make sure that the appropriate personal protective equipment is identified for various phases of construction and is being used by workers. Employers must ensure that workers are trained in the use of specialized protective equipment prior to use; this includes fall protection equipment.

Where there is a danger of making contact with moving parts of machinery, equipment, or tools:

- Avoid loose fitting or frayed clothing, which may get caught.
- Remove accessories such as rings, dangling neckwear, loose-fitting bracelets, and watch bands.
- Confine long hair.
- Wear a short-sleeved shirt and long pants.

Foot protection

Footwear must protect the ankle, sole, and toes. Safety footwear with a CSA green triangle symbol meets these requirements.

It is the worker's responsibility to keep personal safety footwear in good repair. For example, exposed metal toe caps could be hazardous near electricity.

Keep laces tied up at all times to avoid snagging or tripping.



Use safety footwear with a CSA green triangle.

Head protection

When entering a construction site, workers must wear CSA-approved hard hats.

When using a hard hat:

- A chinstrap or ratchet may be required if your job involves constant bending and your head is below the waistline.
- Keep it clean.
- Inspect it regularly.
- Change the suspension harness at least every five years.
- Don't use solvents to clean it.
- Don't drill holes into it unless approved by the manufacturer.
- Don't paint it.
- Don't use it if it has a crack or a deep gouge.
- Don't throw it around or use it as a hammer.



Inspect your hard hat regularly.



There are many options for hearing protection on a construction site.

Hearing protection

Residential construction workers are often exposed to on-the-job noise that can permanently damage hearing.

It's important that workers wear hearing protection when exposed to noise from loud equipment such as air nailers, chop saws, chain saws, circular saws, routers, screw guns, drills, and power planers.

Employers are responsible for providing the required hearing protection. To monitor the effectiveness of hearing protection, construction workers must have their hearing tested every year.

Where communications with co-workers may be critical, hearing protectors that do not block out too much noise should be worn, for example, custom-molded earplugs with vents, earplugs

with a connecting cord, Class B earplugs or earmuffs, and electronic earmuffs or earplugs.

Information on hearing testing, hearing-protection equipment, and hearing-conservation programs can be found on <www.worksafebc.com>. Visit the Health and Safety Centre and choose Hearing Conservation under Health and Safety Topics.

Trenches and excavations

An “excavation” means any cut, cavity, trench, or depression in the earth’s surface resulting from rock or soil removal. It is generally applied to a cavity of any length over 1.2 m (4 ft.) deep and over 3.7 m (12 ft.) wide at the bottom.

A “trench” is any excavation less than 3.7 m (12 ft.) wide at the bottom, over 1.2 m (4 ft.) deep, and of any length.

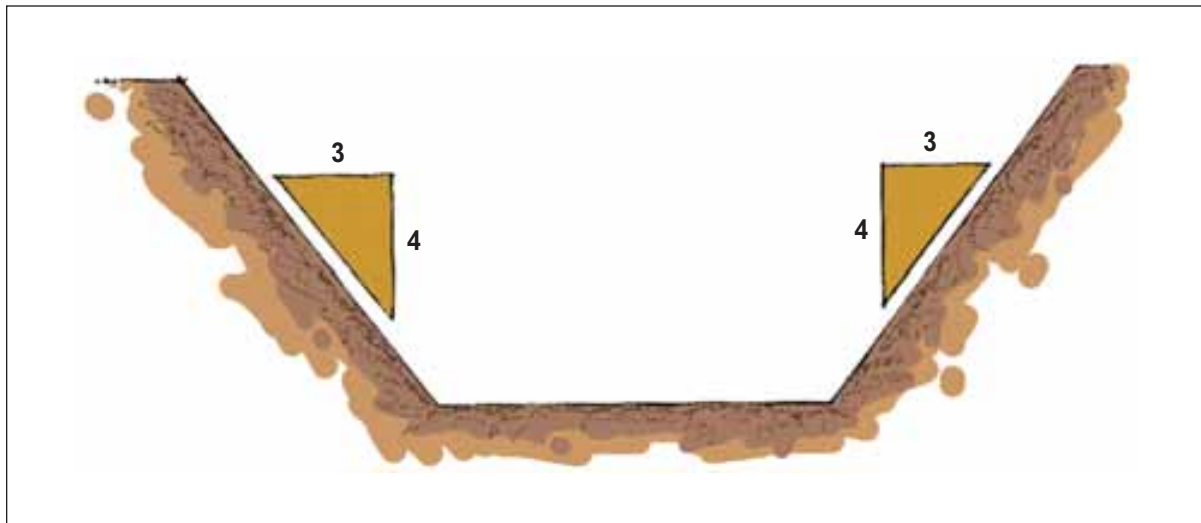
General requirements

- Before beginning to excavate, locate and identify all utility services, such as electrical, gas, steam, water, and sewer in the area. Any danger to workers from these utility services must be eliminated or controlled.
- Pointed tools cannot be used to probe for underground gas and electrical services.
- If possible, blunt shovels should be used to expose the facility. Caution should be taken, especially if newer, sharper spade shovels are used.
- Trees, utility poles, rocks, or similar objects near the edge of an excavation must be removed or secured to prevent workers from being injured.
- Excavation work must be carried out in accordance with the written instructions of a professional engineer or professional geoscientist, when:
 - The excavation is more than 6 m (20 ft.) deep, or
 - Support structures other than those specified in the regulation are used in the excavation, or

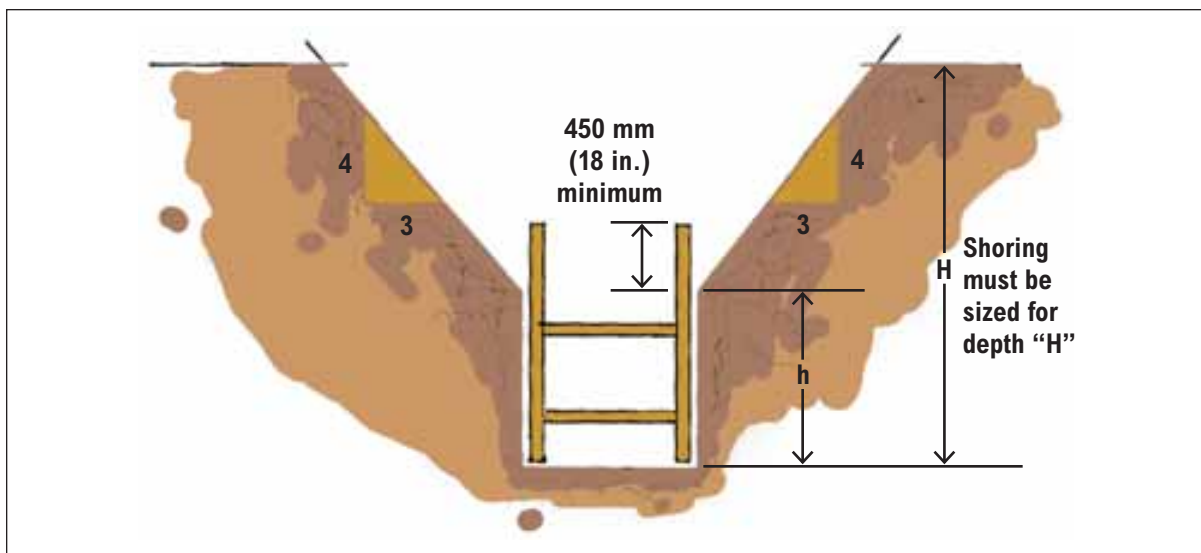
- An improvement or structure is adjacent to the excavation that could endanger workers, or
 - The excavation is subject to vibration or hydrostatic (water) pressure
- A professional engineer’s plan to support or slope the sides of the excavation and written instructions must include information on the subsurface conditions expected to be encountered. A copy of the plan and any written instruction signed and sealed by the engineer must be available at the site.

Sloping and shoring requirements

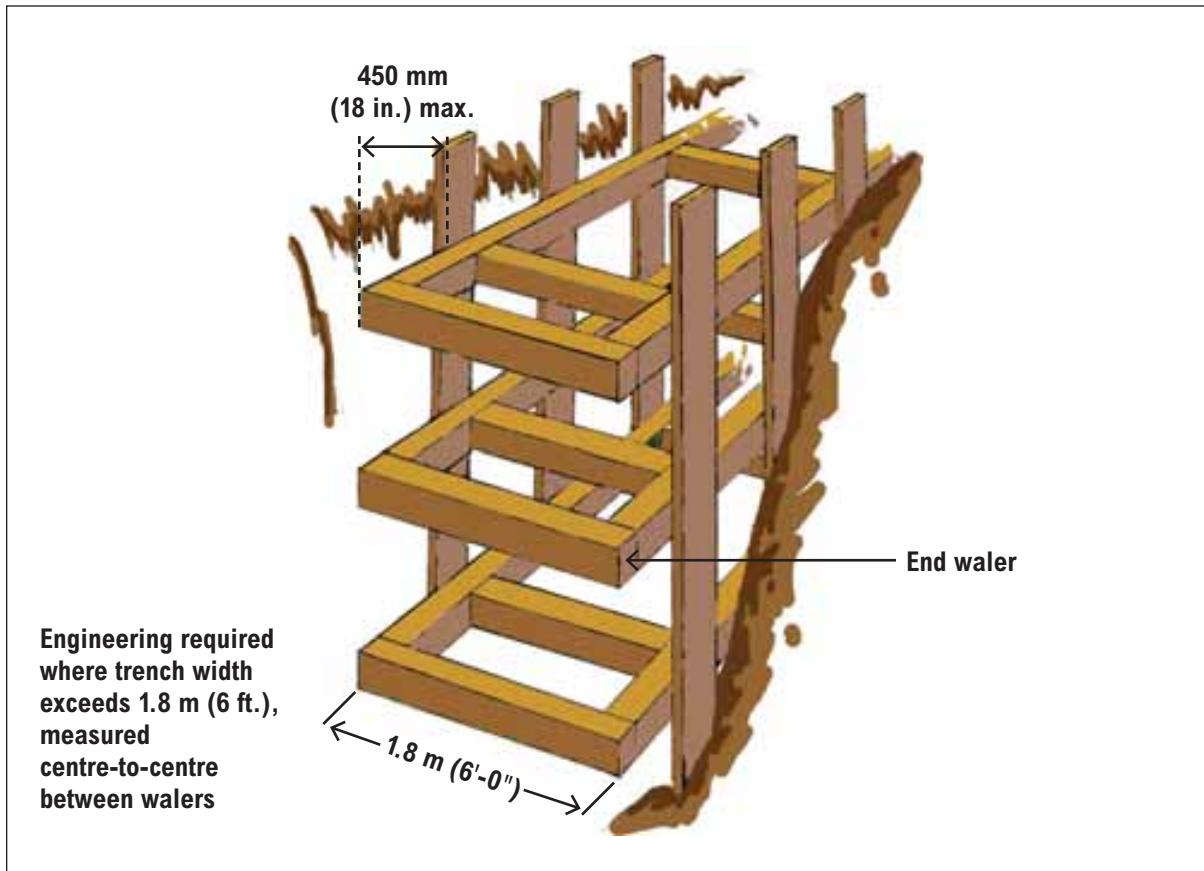
- No worker may enter an excavation over 1.2 m (4 ft.) in depth unless:
 - The sides of the excavation are sloped to a safe angle no steeper than three horizontal to four vertical, or
 - The sides have been supported by use of sheet piling or shoring and bracing, or
 - A combination of both sloping and shoring is used, or
 - The sides of the excavation have been sloped or supported in accordance with the written instruction of a professional engineer



Unshored trench and excavation walls must be sloped flatter than the angle of repose, but in no case steeper than 3 horizontal to 4 vertical unless otherwise specified in writing by a professional engineer.



This is an example of combined sloping and shoring.



This is an example of end shoring for hard and solid soils. Uprights for end shoring are not shown for clarity.

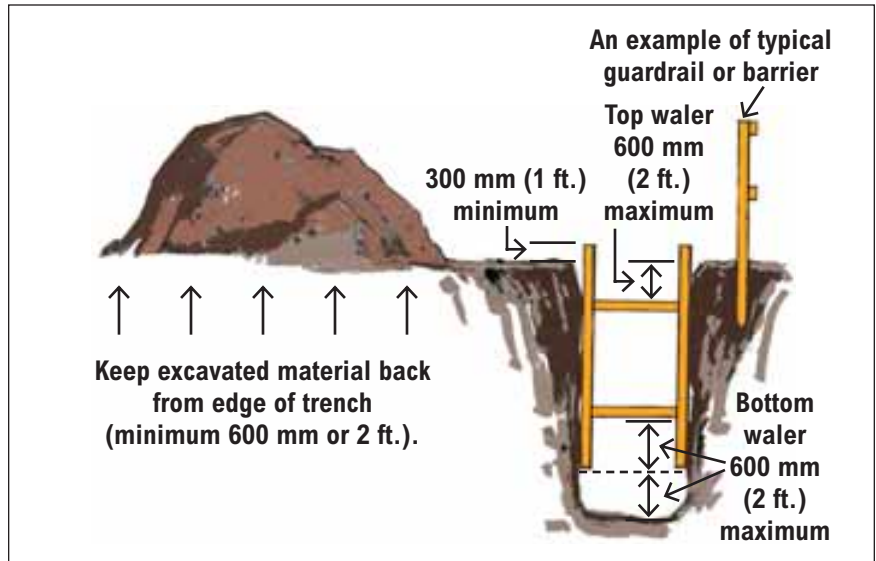
Additional excavation requirements

- Excavation slopes and/or supporting systems must be inspected daily for erosion or deterioration.
- Excavated material must be kept back at least 600 mm (2 ft.) from the edge of any trench excavation and 1.2 m (4 ft.) from any other excavation.
- When necessary, excavations must be covered, or substantial guardrails or barriers must be erected around excavations to prevent workers or other persons from falling into them.
- A ladder must be provided when workers are required to enter excavations over 1.2 m (4 ft.) in depth. The ladder must extend from the bottom of the excavation to at least 1 m (3 ft.) above ground level and be placed so that it is protected by the shoring.

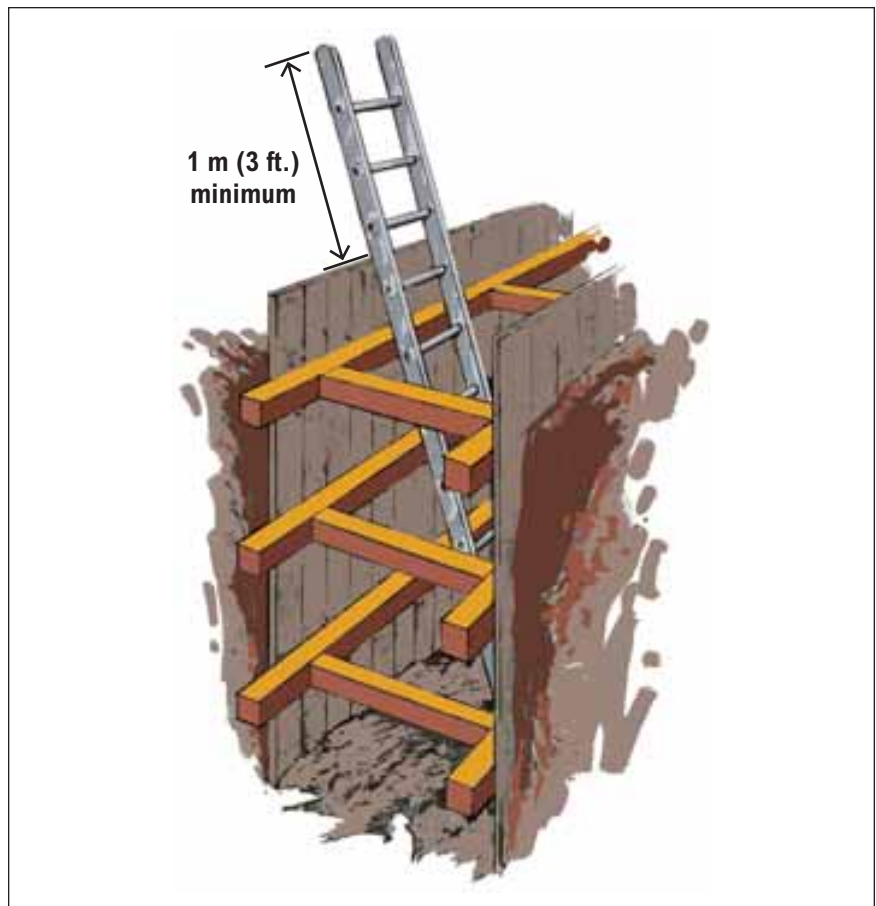
Vertical supports must extend above the ground level a minimum of 300 mm (1 ft.) and must be no more than 600 mm (2 ft.) up from the bottom of the trench.

Top waler must be set at 600 mm (2 ft.) down from the ground level.

Bottom waler must be set at 600 mm (2 ft.) up from the bottom of the vertical support.



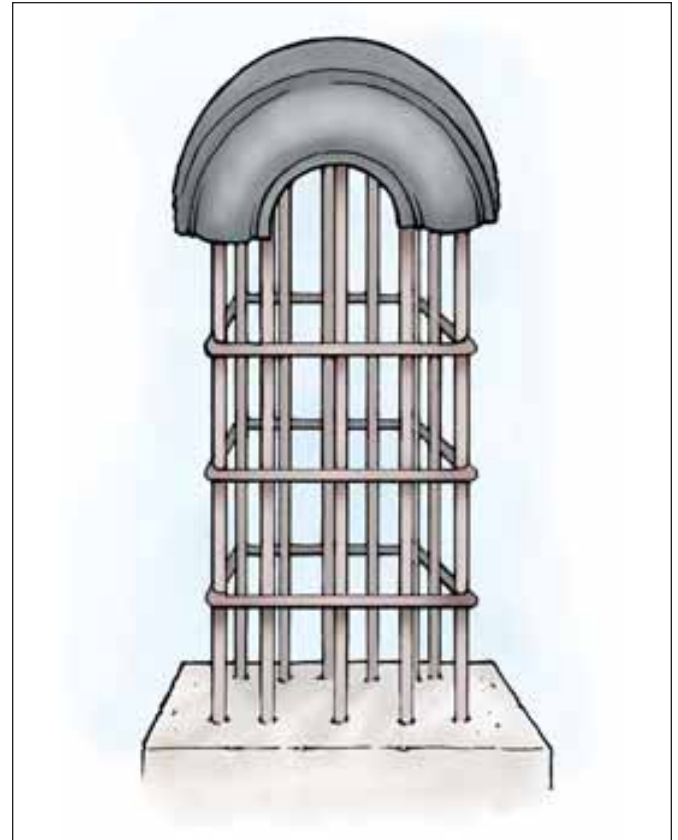
An example of ladder use in an excavation over 1.2 m (4 ft.) deep.



Formwork and pouring

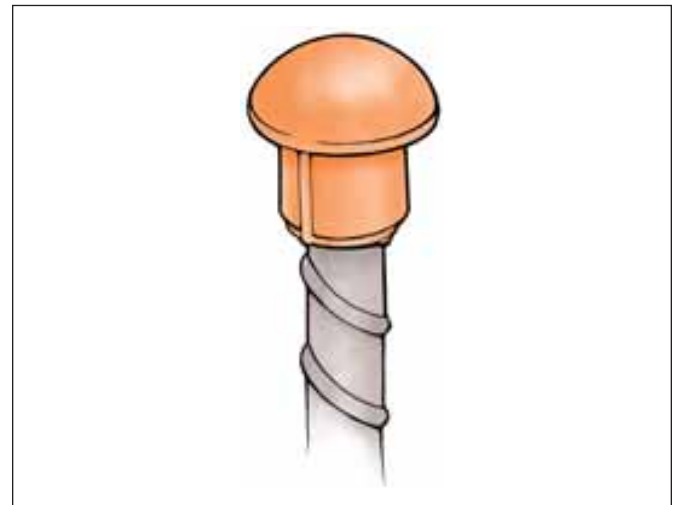
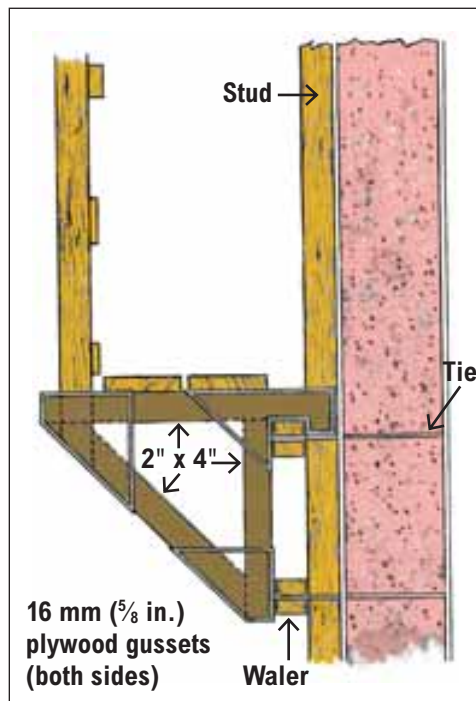
Formwork

- Grade or ground beams are usually the first part of wall forming, and the rebar dowels will protrude above the beam, so that the rebar can be attached to the wall. Protection must be provided to prevent workers from being injured by or impaled on the dowels.
- After the wall forms have been installed, ladders and work platforms must be used to provide safe access to and around the formwork.
- Stripping of the formwork should be done in an organized way that eliminates hazards such as tripping and nail punctures. For example, nails need to be removed or bent as the stripping takes place.
- Formwork bracket scaffolds may be used on wall forms for light-duty work.



This form of protection will prevent impalement.

This type of light-duty formwork bracket can be constructed using either single or double waler systems.



This form of protection will prevent injuries other than impalement.



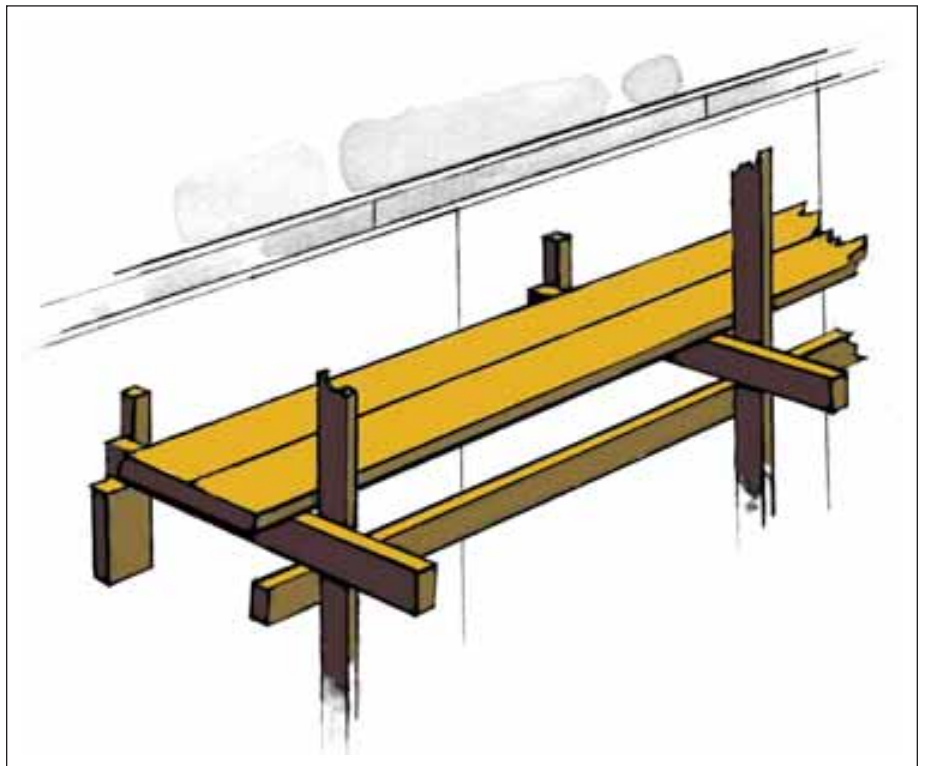
Concrete pouring and pumping

- Exposed skin that contacts wet concrete can become extremely irritated. In some cases, these irritations are serious enough to result in medical and time-loss injuries. To prevent exposure, personal protective equipment is required: hard hat, gloves, and glasses. It is advisable to wear a long-sleeve shirt to protect against both site hazards and sun exposure.
- Unless working on the ground, pouring and pumping of concrete into wall forms must be done from platforms that are a minimum of 510 mm (20 in.) wide and at the correct height, approximately 1 metre (3 ft.) below the top of the form.

Workers must not walk on top of the formwork.

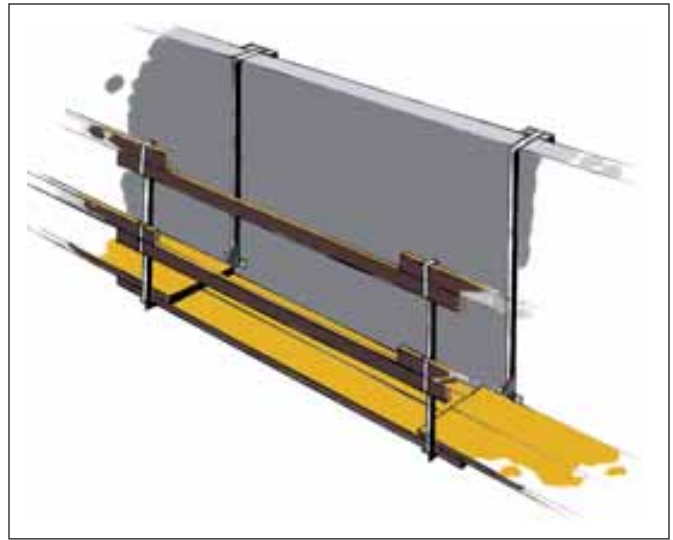


*Single-pole wood scaffold for pouring or pumping concrete.
Note: Guardrails may not be required on scaffold if less than 3 m (10 ft.) above grade.*



General framing

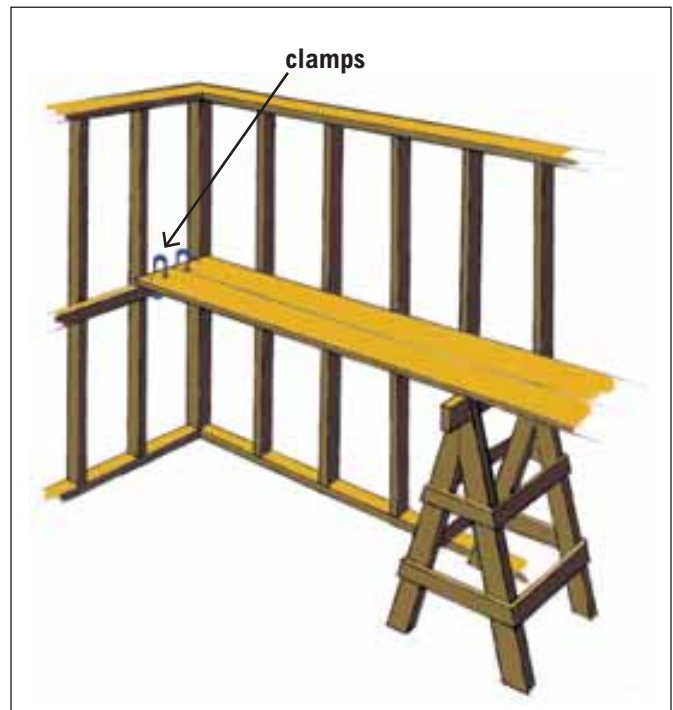
- A key safety step to remember when framing is that workers must not walk or work on interior or exterior walls.
- Wall-mounted brackets and work platforms allow workers to work without walking on the top plate.



Wall-mounted brackets can be mounted inside or outside of the wall.



Workers must not walk on top plates of walls.



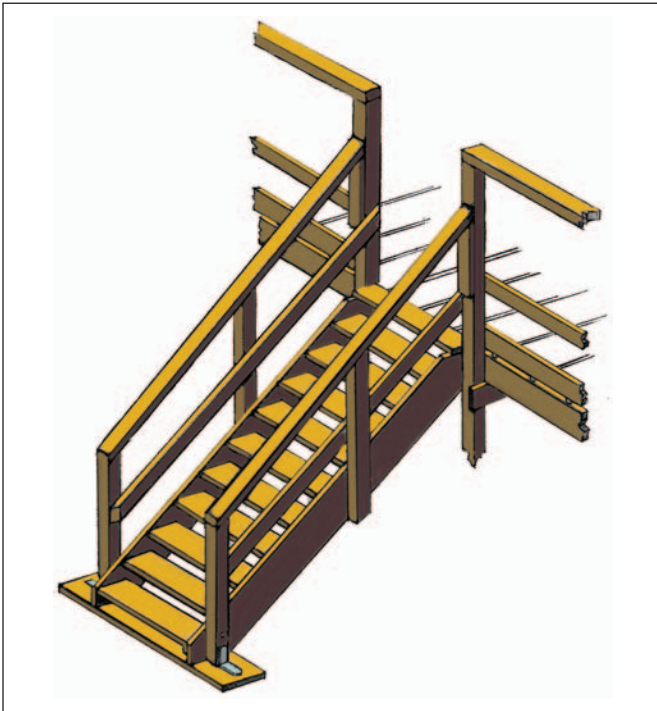
An example of a job-built work platform.

Guardrails and floor openings

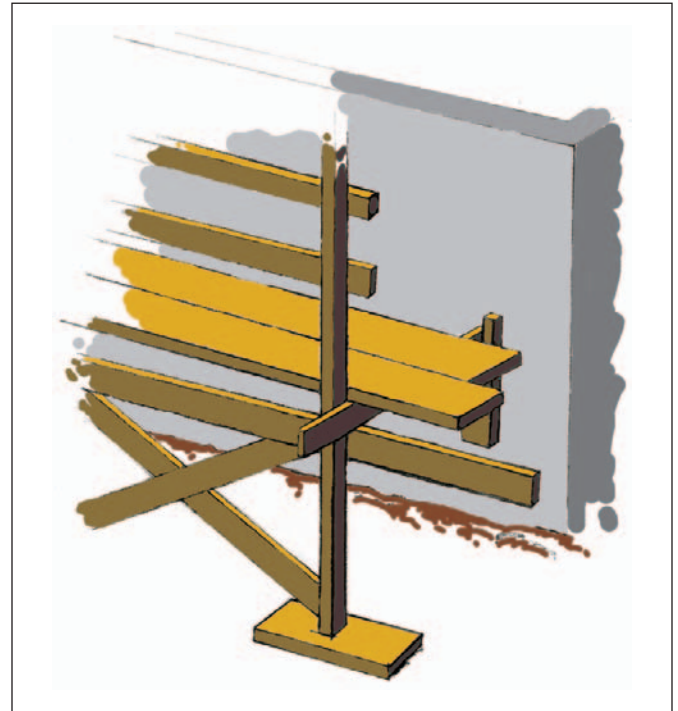
The pressure to do construction work as quickly as possible often results in guardrails not being erected, openings in floors not being covered, or safe access to work platforms not being provided.

- Stairways complete with handrails must be installed before beginning work on the next floor level. Stairway landings, ramps, and walkways that are 1.2 m (4 ft.) or more above grade must have guardrails.

- Workers must be prevented from falling when working 3 m (10 ft.) or more above grade. Standard guardrails or fall protection equipment must be used for this purpose.



Temporary stairway with handrails.



Guardrails are required when the work platform is over 3 m (10 ft.).

Floor and roof openings

Floor and roof openings through which a worker could fall must be securely covered or have standard guardrails erected around them.

- Make sure covers for floor openings are nailed or otherwise secured and well marked.

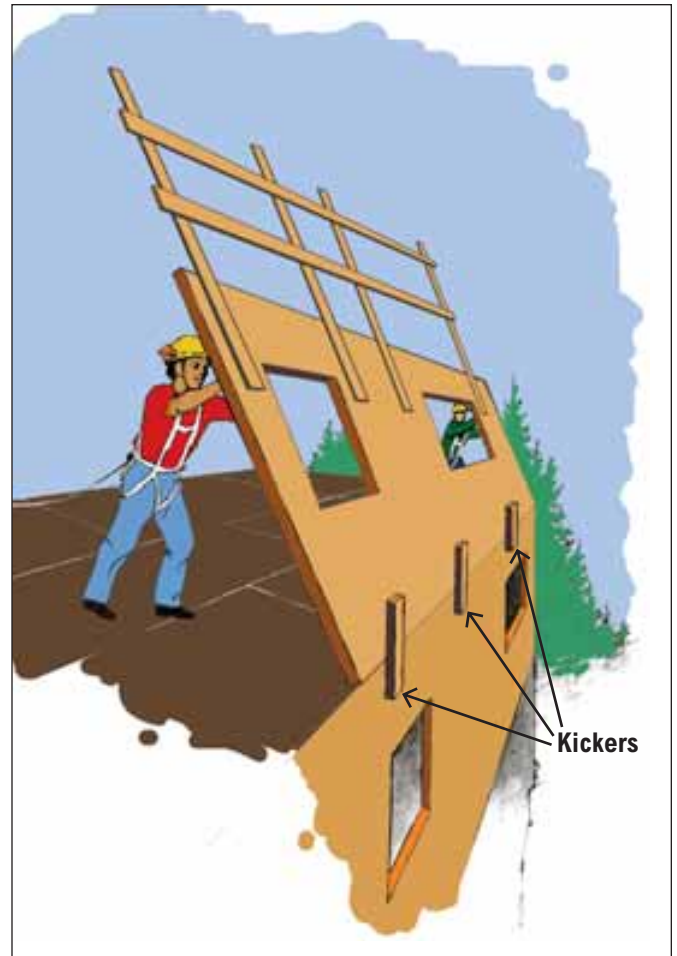


Examples of markings on a plywood cover.

Lifting walls

When lifting walls, consider the following:

- Ensure that all workers understand the lifting process. Only one person should give the instruction and direction.
- Have an adequate number of workers to carry out this job in a safe manner.
- Install kickers to prevent the bottom of the wall from slipping off the subfloor.
- Ensure no workers are in the area below the wall being lifted.
- Do not lift walls in excessively windy conditions.
- Make sure fall protection is provided to workers near the edge.
- Install temporary braces immediately after the wall is in an upright position.



Install kickers to prevent the bottom of the wall from slipping off the subfloor. Also, rails can be nailed prior to lifting to deter walking on top plates and provide fall protection to workers on the next level.

Fall protection

Falls from ladders, roofs, floor, and scaffolding are a common cause of injury in the residential home building industry. Providing fall protection for all circumstances in the building of a house can be difficult but employers must take all reasonable steps to ensure that their workers are protected.

Pre-planning for fall protection is required by regulation for all contractors and sub-contractors. This includes prime contractors, forming and framing contractors, siding and stucco contractors, masonry contractors, and any other employers who have workers that may be exposed to a fall during the course of the work.

The Occupational Health and Safety Regulation defines the following systems describing the methods for providing fall protection:

Fall protection system means (a) a fall restraint system, (b) a fall arrest system, (c) work procedures that will minimize the potential for a worker to fall, such as the following:

- Guardrails
- Safety belts or full body harnesses with a lanyard and/or lifeline and an anchor, and their related equipment
- Safety nets
- Other procedures acceptable to WorkSafeBC

Fall restraint system means a system to prevent a worker from falling from a work position, or travelling to an unguarded edge from which the worker could fall – for example, guardrails or a personal fall protection system.

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

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

- (a) A safety belt or full body harness, and
- (b) A lanyard, lifeline, and any other connecting equipment individual to the worker

that is used to secure the worker to an individual point of anchorage or to a horizontal lifeline system.

Note: An anchor for fall arrest must be able to support 22 kN (5000 lb.) while an anchor for fall restraint must be able to support 3.5 kN (800 lb.). Roof trusses cannot be used as anchor points, because they are designed for compression not tension.



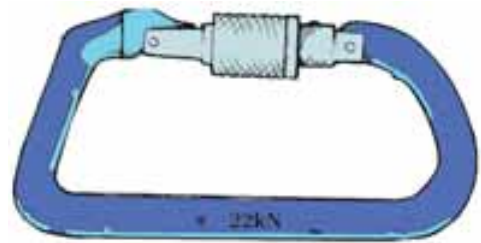
This is an example of a fall arrest system.



This is an example of a fall restraint system where worker cannot fall off edge.



Sliding rope grab



Carabiner



Lanyard



Shock-absorbing lanyard

Selecting fall protection

When determining which system is most practicable you must always follow the hierarchy as set out in section 11.2 of the Occupational Health and Safety Regulation.

1. Are guardrails practicable? Must be able to withstand 550 N (125 lb.) laterally.
2. Can another fall restraint system be used?
That is, a harness or belt attached to an anchor at one end and a worker at the other end in a way that will not allow the worker to fall; anchor must be able to withstand 3.5 kN (800 lb.).
3. Can a fall arrest system be used?
That is, a harness attached to an anchor that is able to withstand 22 kN (5000 lb.) or two times the maximum arrest force.
4. If none of the above systems can be used, other written procedures acceptable to WorkSafeBC can be used.

A written fall protection plan may also be required, see section 11.3 of the Occupational Health and Safety Regulation. A sample blank form for a fall protection plan has been provided on page 32.

Planning for fall protection on your project

When planning for fall protection, consider the following:

- Workers who will be installing the guardrails and anchor systems must have fall protection and be experienced in this type of work.

- Training and supervision must take into account the experience of the workers required to work at heights.
- Safe access must be provided to work areas. Note: Ladders (inspected prior to use) may be used for access and egress only if they can be secured at a safe slope of a maximum 4 to 1 ratio; this means for every 1.2 m (4 ft.) vertical, the bottom of the ladder must be 300 mm (1 ft.) out from the wall; and the top of the ladder must be extended 1 m (3 ft.) above the landing and secured against movement.
- Scaffolding must be built and erected according to acceptable standards (CSA standards or the Scaffold Industry Association Guidelines).
- All balconies, landings, and open-sided floors must have guardrails and toeboards installed if there is a possibility of any tools or materials falling.
- Walls can be framed with a guardrail system prior to being raised, to prevent workers from walking on top plates (see diagram on page 24).
- Floor and roof openings must be securely covered and marked if they pose a fall hazard.
- Work to be done at 7.6 m (25 ft.) or more above grade will require a site-specific written fall protection plan and training of the workers at risk.
- Swing hazards in fall arrest systems must be avoided.

Fall protection systems must be used when there is the possibility of a fall from 3 m (10 ft.) or more.

- Both toe-hold (slide guard) and fall protection systems must be used when a roof has a slope of 8 x 12 (vertical to horizontal) or more. Toe-holds (slide guards) must be at least 38 mm x 140 mm (2 in. x 6 in. nominal size lumber). They are generally installed after the first three courses of shingles have been installed. The slide guards will be installed along the full length of the roof at the eaves and set approximately 90 degrees to the roof. On roofs of 6-in-12 and up to and including 8-in-12, additional slide guards will be required above the eaves at a distance not to exceed 2.4 m (8 ft.) vertically.
- Once the roofing is complete to the ridge, the guards may be removed progressively by standing on the one below. A secured ladder will be required to remove the last of the guards at the eaves level.



These are examples of various fall protection anchors used for sloped roof applications.



These are the same anchors installed.

Fall protection plan

Site	Work area
Describe tasks	
Fall hazards	
Special assembly/disassembly procedures	
Rescue procedures	
Workers who received training	
1. _____	4. _____
2. _____	5. _____
3. _____	6. _____
The contents of this work plan have been conveyed to all workers of _____ _____ and their sub-contractors exposed to fall hazards where the use of a fall protection system is required.	
Supervisor's signature	Date

Trusses

Instruction for truss installers

Builders and truss installers must familiarize themselves with all written instructions, drawings, and documents provided by the truss manufacturer and building designers. Before truss installation begins, builders and truss installers need to:

- Know the truss layout.
- Review individual truss drawings that contain information for placing, erecting, bracing, and connecting trusses.
- Check markings on trusses to ensure proper placement according to design.

Truss erection

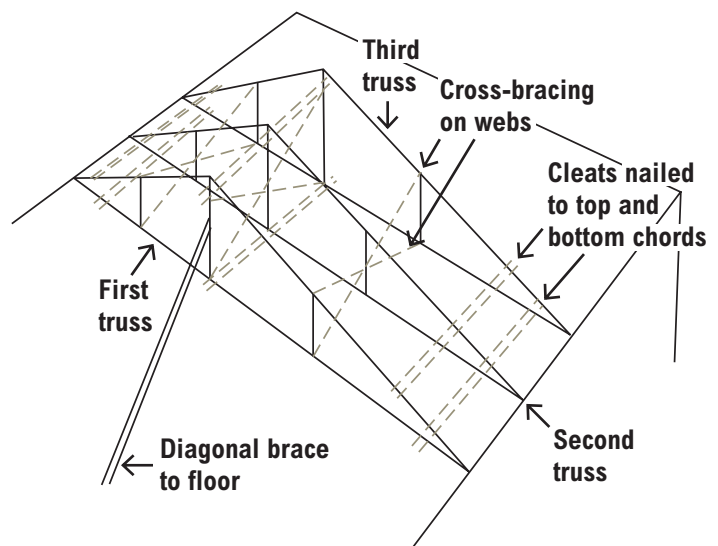
Preparing for truss erection

- Ensure that all documents, drawings, and instructions related to the safe installation of trusses are available on site.
- Instruct workers on safe truss installation procedures (using documents mentioned above).
- Use workers experienced in safe truss installation whenever possible.
- Ensure that the installation will be supervised by someone who is experienced and knowledgeable in proper truss erection procedures.
- Check that the interior and exterior walls are properly aligned and adequately braced.
- Store trusses (if required) bundled, protected from the rain, and evenly supported to prevent twisting.

- Inform other workers not involved in truss installations to keep clear of the area when trusses are being handled and positioned.
- Ensure that there will be a worker, properly trained in crane signals, directing the unloading and placement of the trusses.
- Determine and implement a fall protection system for truss installation and bracing.
- Ensure that proper personal protective equipment is used by workers.

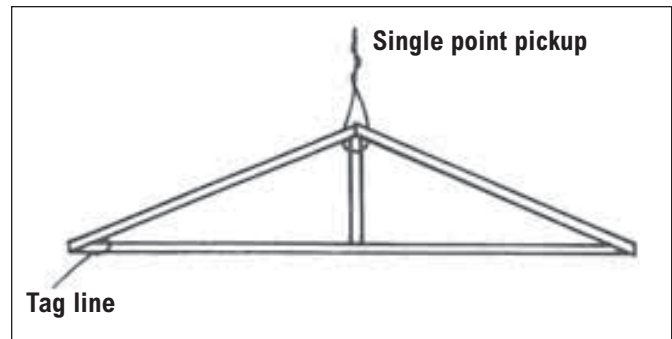
Temporary bracing during truss erection

- Lift and place truss bundles flat on top of walls (which are aligned and pre-braced).
- Start with any series of trusses having a minimum of three trusses with the same span.
- Use eye protection when cutting banding straps to avoid eye injury.

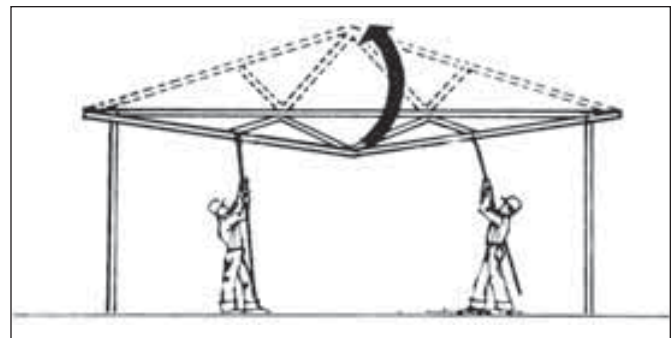


Temporary bracing

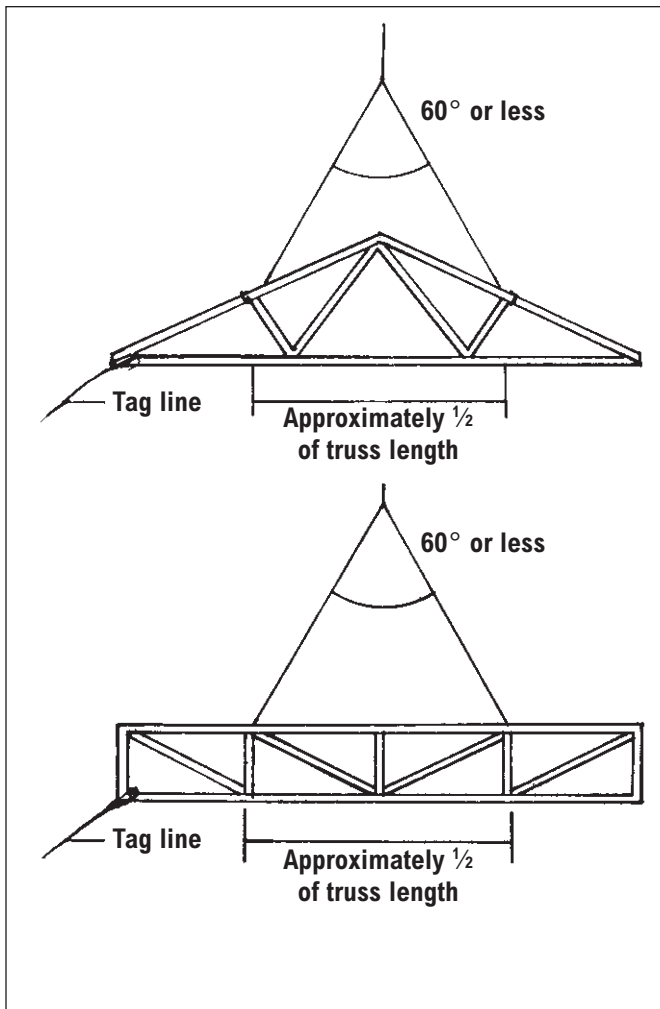
- Attach slings at panel points and not mid-span on truss members.
- Use tag lines to avoid trusses from swinging (which may damage truss itself or other work).
- Stand the first truss and brace it diagonally from above the mid-point on the inside web (to avoid tilting) to the floor below.
- If starting with a hip end, use the jack trusses to brace the hip girder (nail at both top and bottom chords).
- Erect and space the second truss and brace it to the first truss by nailing a 38 mm x 89 mm (2 in. x 4 in.) cleat to the top and bottom chords of both trusses, maintaining 3 m (10 ft.) on centre (o/c).
- Erect third truss and nail cleats to top and bottom chords same as for second truss. Install cross diagonal bracing inside the trusses, nailed to the side of the webs at 2.4 m (8 ft.) o/c.
- Continue using cleats on top and bottom chords and brace subsequent trusses to the first three trusses.
- Install permanent bracing according to manufacturer's or designer's instructions prior any other work (e.g., strapping, sheathing or loading with materials).



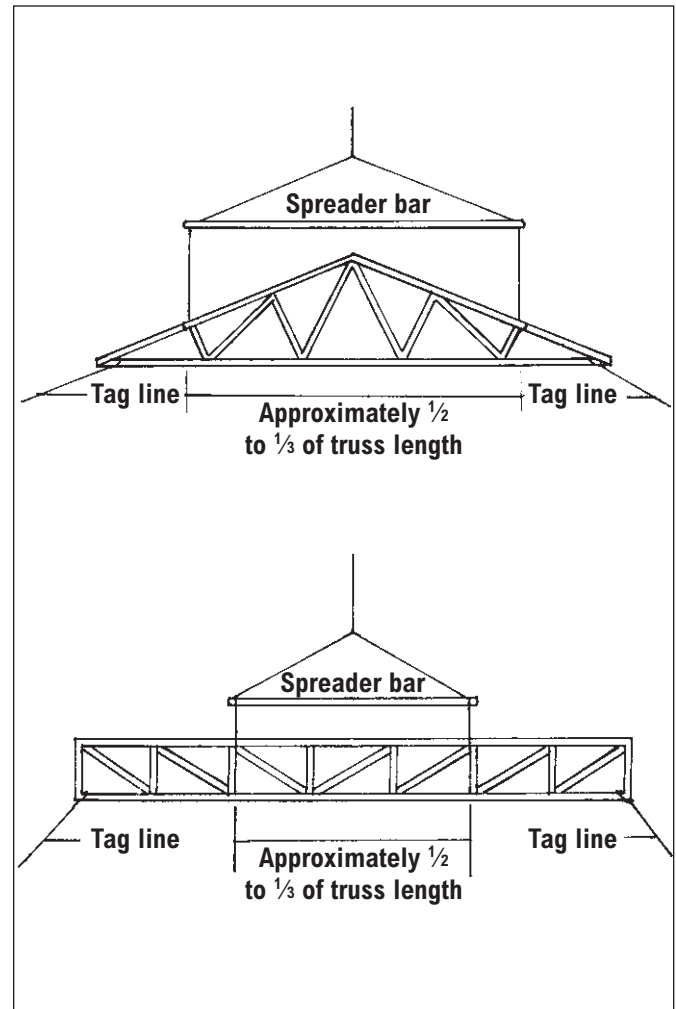
For spans of 6 m (20 ft.) or less, a single pickup point may be used to lift the truss.



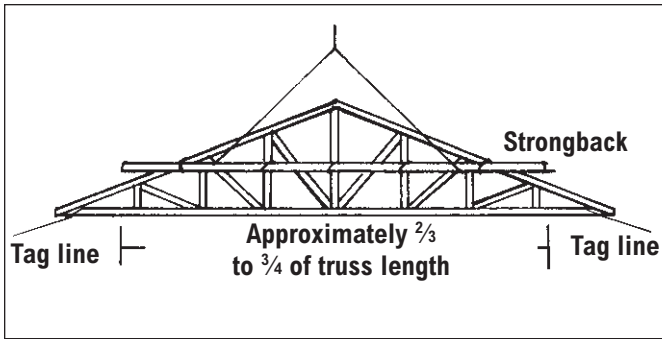
Small trusses may be installed by hand when extra care is taken to prevent excessive lateral bending when positioning each truss.



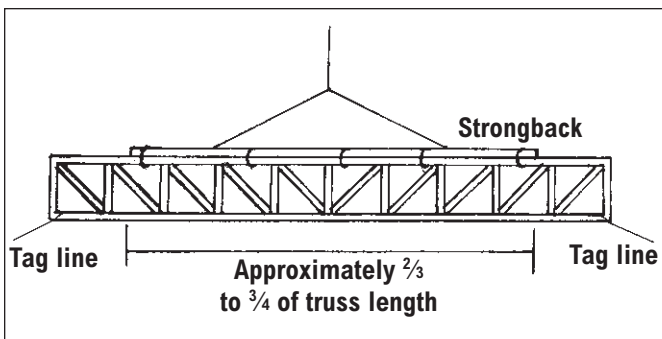
Trusses up to 9 m (30 ft.) in length should be lifted using two pickup points so that the distance between them is approximately one-half the length of the truss.



A spreader bar and short wire rope slings should be used to lift trusses 9–18 m (30–60 ft.) long. The slings may be vertical or may toe-in. Two tag lines should be used to control the raising of trusses of this size.



Trusses should be positioned low enough on the strongback to prevent overturning of the truss.



For flat trusses, the strongback should be tied to the top chord.

Trusses over 18 m (60 ft.) in length should be lifted with a strongback that is two-thirds to three-quarters of the length of the truss. The truss should be securely tied to it at 3 m (10 ft.) intervals or less. Two tag lines should be used to control the truss during lifting.

Permanent truss bracing

Permanent bracing instructions for the floor or roof truss systems are the responsibility of the building designer and should be shown on the framing plans. Permanent bracing for individual members of a wood truss component is shown on the truss design drawings and must be installed by the builder or truss erection contractor to ensure proper performance of the truss system.

Roof work

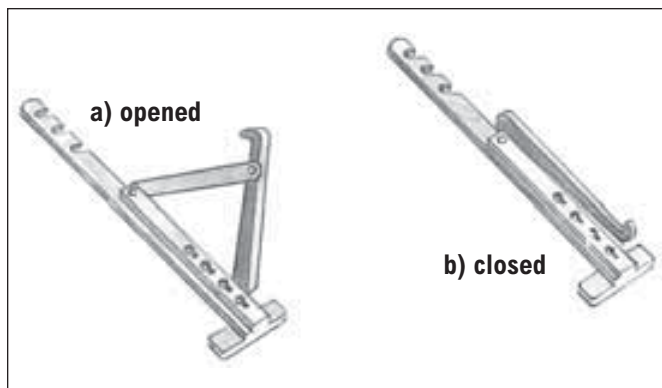
Fall protection systems must be used when there is the possibility of a fall from 3 m (10 ft.) or more.

- Each person working on the roof must have their own individual fall arrest system; this includes an anchor capable of withstanding a superimposed load of 22 kN (5000 lb.).
- Both toe-hold (slide guard) and fall protection systems must be used when a roof has a slope of 8 x 12 (vertical to horizontal) or more. Toe-holds (slide guards) must be at least 38 mm x 140 mm (2 in. x 6 in. nominal size lumber). They are generally installed after the first three courses of shingles have been installed. The slide guards will be installed along the full length of the roof at the eaves and set approximately 90 degrees to the roof. On roofs of 6-in-12 and up to and including 8-in-12, additional slide guards will be required above the eaves at a distance not to exceed 2.4 m (8 ft.) vertically.
- Once the roofing is complete to the ridge, the guards may be removed progressively by standing on the one below. A secured ladder will be required to remove the last of the guards at the eaves level.
- Areas in danger of falling objects must either be barricaded to prevent entry or be protected with a proper canopy or catch platform.
- Do not stack any materials within 2 m (6 ft.) of the rake edge.

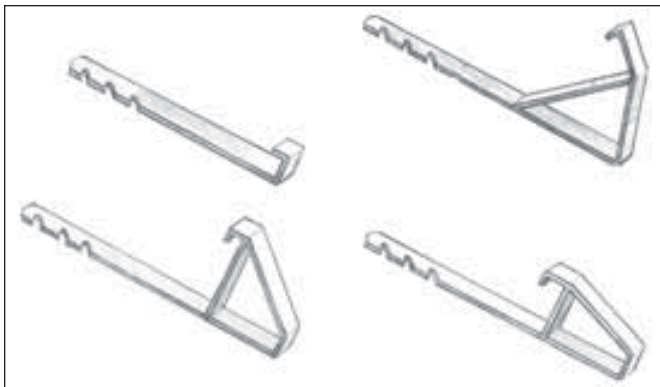


An example of a worker using both fall restraint equipment and a toe-hold.

A slide guard system may be considered as a possible option when working on sloped roofs when other methods of fall protection are considered not practicable. Slide guards are designed to prevent workers from sliding off a sloped roof. Slide guards typically use manufactured brackets that hold 2 x 6s mounted at 90° to the roof slope. Slide guards should only be used on roofs with slopes from 3:12 to 8:12.



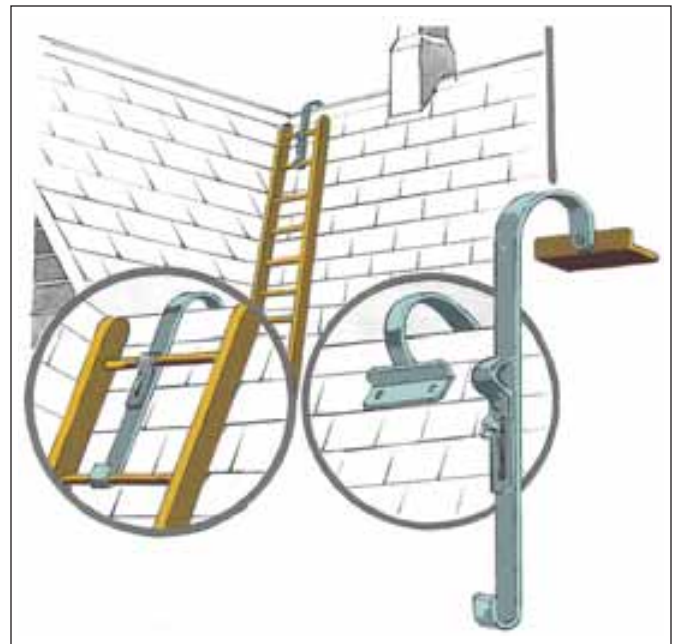
Folding roof jacks.



These are examples of various kinds of roof jacks.

Roof jacks and toe-holds (slide guards)

- Roof jacks must be of substantial construction and maintained in good condition.
- Roof jacks must be provided with effective non-slip devices.
- Exposed horizontal roof strapping may be used as toe-holds as long as it provides safe footing.
- Crawl boards or ladders, used for roof work, must be securely fastened over the ridge of the roof or must be otherwise effectively anchored. The use of eavestroughs for support is prohibited.



Scaffolds

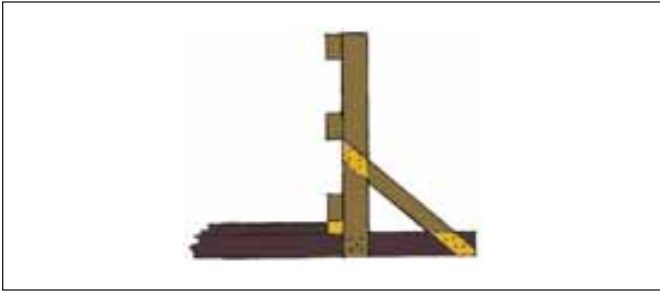
- The vertical supports of scaffolds must be placed on a firm base or sill and be capable of withstanding superimposed weight from the scaffolding and anything placed on the scaffold. Do not use pallets, boxes, concrete blocks, bricks, or other unstable material to support scaffolds.
- Scaffold erection and dismantling must be done or supervised by qualified workers experienced in this work.
- All scaffolding must be erected plumb and level, and be designed for the intended use.
- Scaffolds must be secured to the building structure approximately 4.6 m (15 ft.) vertically but not to exceed 6.1 m (20 ft.) and 6.4 m (21 ft.) horizontally.
Note: narrow scaffolds must be secured to the structure when the platform height exceeds three times the smallest base dimension.
- Bracing requirements for prefabricated scaffolds must be installed according to the manufacturer's instructions. Bracing for job-constructed scaffolding must meet standards acceptable to WorkSafeBC requirements.
- All scaffolds must be inspected before use by those who will use them, regardless of who erected them. No damaged or weakened scaffold may be used until it has been effectively repaired.

Guardrails for scaffolds

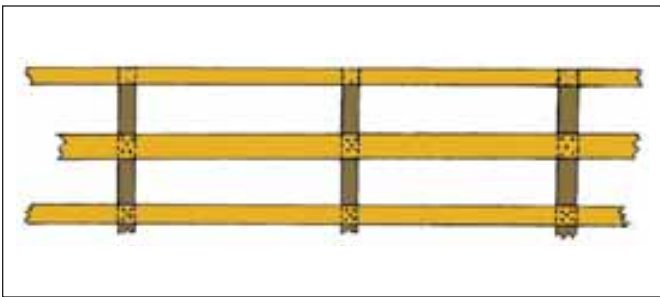
- All scaffolds 3 m (10 ft.) or more above grade must have standard guardrails on their open sides. A standard guardrail consists of:
 - A top rail approximately 1.1 m (42 in.) above the platform
 - An intermediate rail centred at approximately the midpoint of the space between the underside of the top rail and upper edge of the platform
 - Vertical guardrail supports spaced not more than 3 m (10 ft.) apart for wooden scaffolding
- Standard guardrails must be designed to withstand a static load of 550 N (125 lb.) applied laterally at any point on the top rail.
- Metal guardrail systems must be of height and strength equivalent to a standard guardrail.



This is an example of a metal guardrail system.



This is an example of a cantilever guardrail detail.



This shows a detail of a standard guardrail.

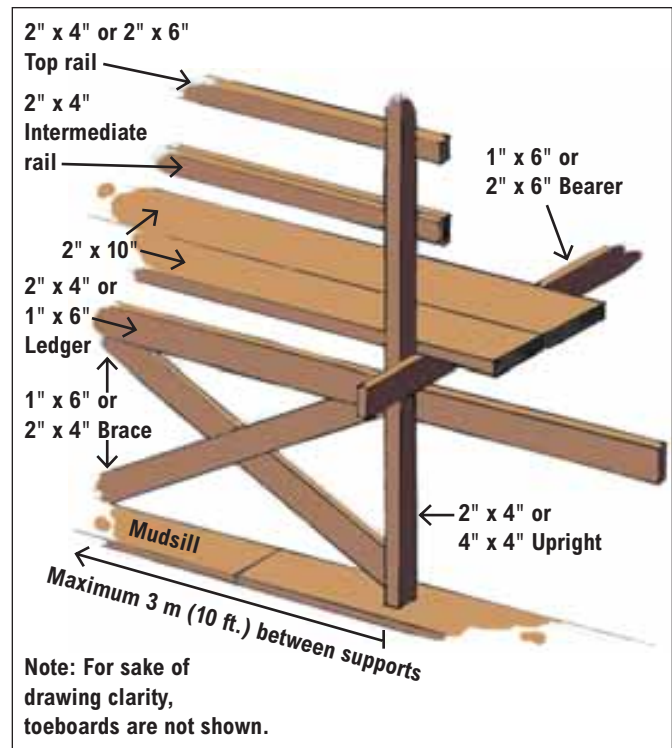
Toeboards for scaffolds

- When the scaffold is installed over machinery or adjacent to workers who could be struck by falling material or tools, a toeboard will be installed on all the open sides of the scaffold. In the case of blocks or bricks, precautions must be made by either extending the height of the toeboard or by installing mesh or similar material in the space between the toeboard and the guardrail to prevent an object from falling.
- The space between the front edge of the scaffold and the building structure must not exceed 30 cm (12 in.)

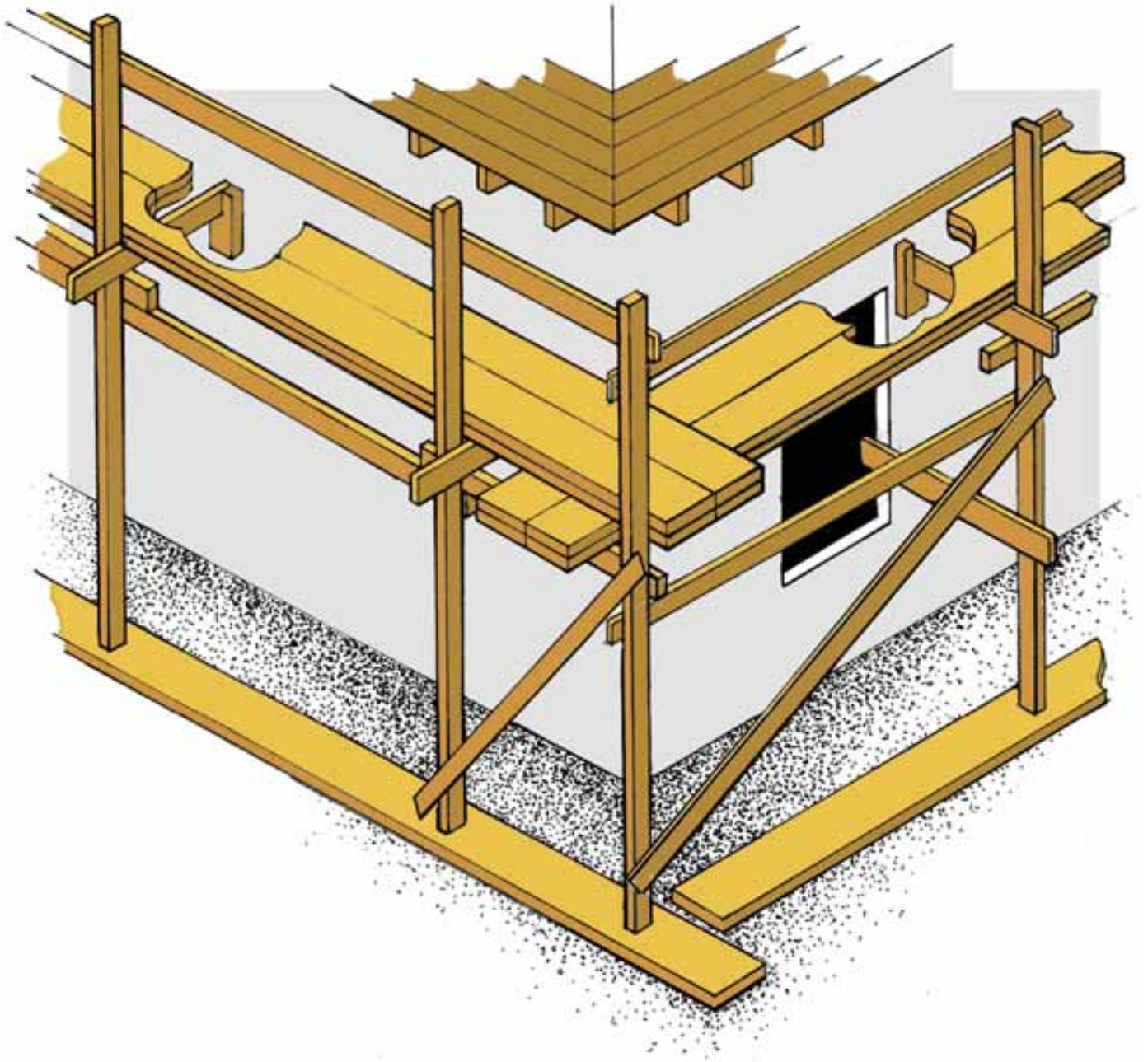
Wood scaffold erection guidelines

General requirements

- Wood scaffolding must be constructed using No. 2 or better lumber (Douglas fir-larch, hemlock-fir, spruce-pine-fir or coast-Sitka-spruce species). To eliminate split, warped, or otherwise defective lumber, scaffold materials should be hand-selected.
- Progressively brace the scaffold as it is being erected.
- Make sure there is firm contact between bearer blocks, bearers, wall scabs, and ledgers to provide maximum strength at connecting points.



This is an example of a single-pole wood scaffold (light duty). Where alternatives are given, it may depend on the span (see table on page 42).



This diagram shows an example of a typical single-pole wood scaffold for light duty.

- The number and size of nails and nailing patterns at connections should be consistent with good practice. As a guide, nails should protrude at least $\frac{2}{3}$ of the thickness into the adjoining piece of lumber.
- Where holding power is critical or the scaffold will be used for an extended length of time, dip-galvanized or spiral nails should be used. When scaffold components are intended to be dismantled and reused, double-headed nails may be used.
Caution: do not use the same nail holes on re-assembly.
- Do not exceed the maximum allowable dimensions for bearers and upright spacing.

- Do not overload the scaffold.
- The spacing of vertical supports (uprights) and bearers must not exceed 3 m (10 ft.).

Design and erection requirements for job-constructed wood scaffolds

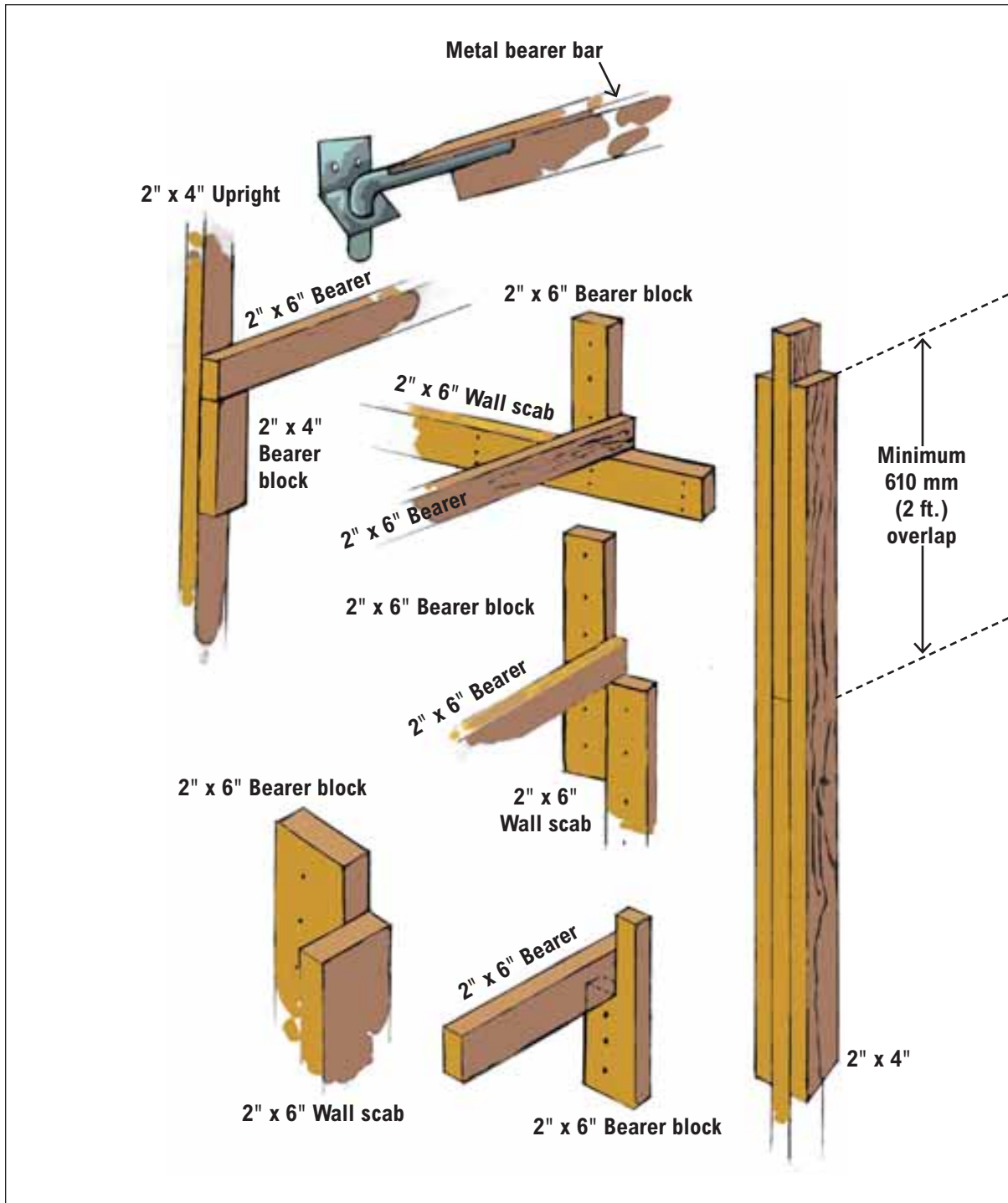
Single-pole wood scaffold — light duty

The spacing of vertical supports and bearers of a single-pole wood scaffold for light duty must not exceed 3 m (10 ft.).

- On single-pole scaffolds, the inner ends of bearers must be supported by bearer blocks and must be securely fastened to wall scabs.

Scaffold Component	Dimensions (Inches)*
Uprights – Up to 6 m (20 ft.)	2 x 4
– 6 m to 15 m (20 ft. to 50 ft.)	4 x 4
Bearers – 900 mm (3 ft.) maximum span	1 x 6
– 1.5 m (5 ft.) maximum span	2 x 6
Ledgers (ribbons)	1 x 6 or 2 x 4
Braces	1 x 6 or 2 x 4
Wall scabs and bearer blocks	2 x 6
Minimum work platform width	(2x) 2 x 10
Guardrails – Top, up to 2.4 m (8 ft.) span	2 x 4
– Top, 2.4 m to 3 m (8 ft. to 10 ft.) span	2 x 6
– Intermediate	2 x 4
Toeboards	1 x 4
Scaffold planks	See section 13.24 of the OHS Regulation
* These are “nominal” dimensions. They refer to the name of the dressed lumber, not the actual measurement.	

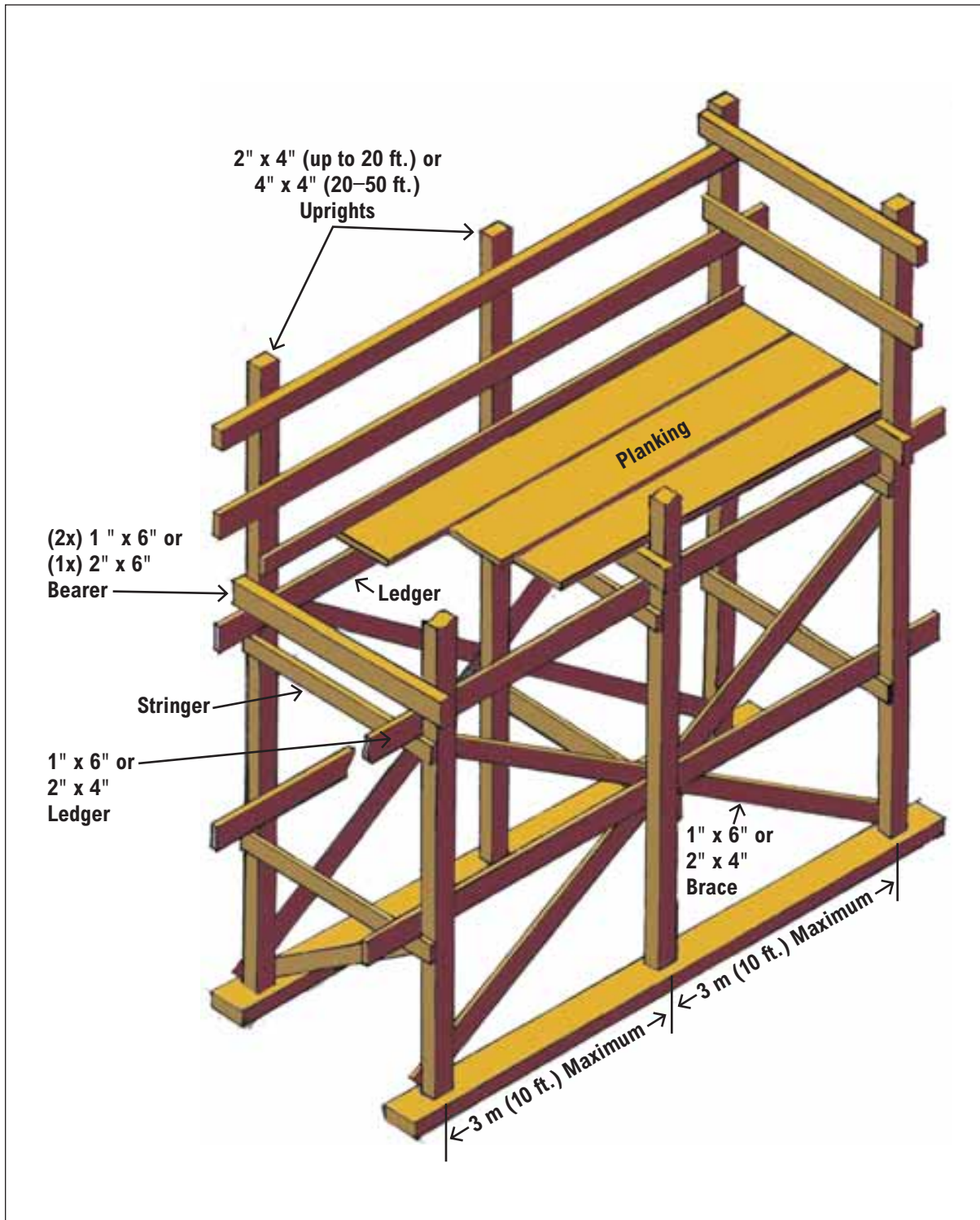
Bearer connections at wall



These are examples of bearer connections.

Double-pole wood scaffolds — light duty and heavy duty

Component	Dimensions (Inches) Light Duty	Dimensions (Inches) Heavy Duty
Uprights		
0 to 6 m (20 ft.)	2 x 4	2 x 6
6 to 15 m (20 ft. to 50 ft.)	4 x 4	4 x 6
Bearers		
1.5 m (5 ft.) maximum span	(2x) 1 x 6 or (1x) 2 x 6	(2x) 1 x 6 or (1x) 2 x 6
Ledgers	1 x 6 or 2 x 4	1 x 6 or 2 x 4
Braces	1 x 6 or 2 x 4	1 x 6 or 2 x 4
Minimum work platform width	(2x) 2 x 10	(2x) 2 x 10
Guardrails (top)		
Up to 2.4 m (8 ft.) span	2 x 4	2 x 4
2.4 m to 3 m (8 ft. to 10 ft.) span	2 x 6	2 x 6
Guardrails (intermediate)	2 x 4	2 x 4
Toeboards	1 x 4	1 x 4
Scaffold planks	See WCB Standard WPL 1, Design, Construction and Use of Wood Frame Scaffolds, 2004	See WCB Standard WPL 1, Design, Construction and Use of Wood Frame Scaffolds, 2004



This is a double-pole scaffold (light duty only).

Scaffold planks

- All scaffold planks must be inspected and tested before use.
- Lumber or manufactured scaffold planks used for a work platform must consist of at least two planks placed side by side to provide a work surface with a nominal width of 50 cm (20 in.), or a nominal width of 30 cm (12 in.) for ladder-jack platforms.
- Scaffold planks should completely cover the area between front and rear vertical supports or the rear guardrail.
- Scaffold planks must be secured against any movement in any direction (including uplift).
- The maximum spans using the above specifications are:
 - 3 m (10 ft.) for light-duty scaffolds
 - 2.1 m (7 ft.) for heavy-duty scaffolds
- Lumber used for planks must be graded and marked to the National Lumber Grades Authority (NLGA) *Standard Grading Rules for Canadian Lumber*.

Sawn wood planks (lumber planks)

- Sawn wood planks must be hand-selected from Douglas fir-larch, hemlock-fir, spruce-pine-fir, or coast-Sitka-spruce only and in the following grades and sizes:

Grade	Minimum Width	
	(mm)	(Inches)
Select Structural — Scaffold Planks	38 x 235	2 x 10 (nominal)
Select Structural — Joists & Planks	38 x 235	2 x 10 (nominal)
No. 2 and Better — Joists & Planks	48 x 251	2 x 10 (rough sawn)
No. 2 and Better — Joists & Planks*	38 x 235	2 x 10 (dressed/nominal)
* Important: These planks must be doubled, one on top of the other.		

Testing procedure

Manufacturer's specifications must be followed for testing laminated wood scaffold planks. The following is an acceptable method of testing sawn wood scaffold planks.

- Place test scaffold plank on two blocks. The block size and test span must be selected from the following table:

Test Span	Block Size
2.1 m (7 ft.)	60 mm (2 ³ / ₈ in.)
3 m (10 ft.)	92 mm (3 ⁵ / ₈ in.)

- Have two workers who together weigh at least 148 kg (325 lb.) stand on the centre of the supported plank. Do not jump up and down on the plank.



To test a plank, have two workers stand on the centre of it.

- Reject the plank if:
 - The plank bends enough to contact the ground
 - Cracking sounds are heard, indicating fibre overstressing
 - After removal of the test load, the plank fails to return to its original position, that is, it remains bent

- Scaffold planks passing this test should be identified by stencilling or end painting. It is also advisable to have the ends of the planks encased in metal sleeves or jackets for damage protection and additional identification.

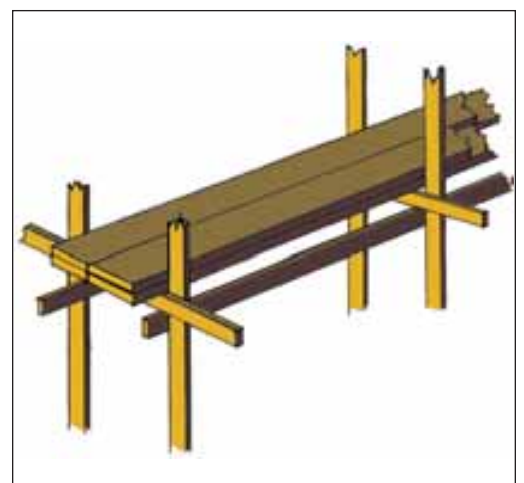
To prevent damage, scaffold planks must be handled carefully, used correctly, and properly stored.

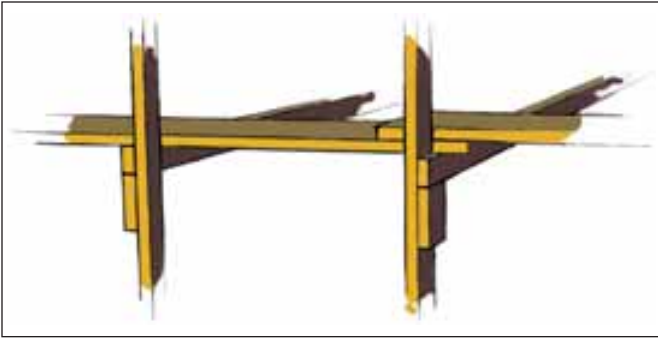
Scaffold planks must never be overloaded, used as sills, or subject to any condition that could affect the integrity of the plank as a working platform.

Example of planks placed side by side.

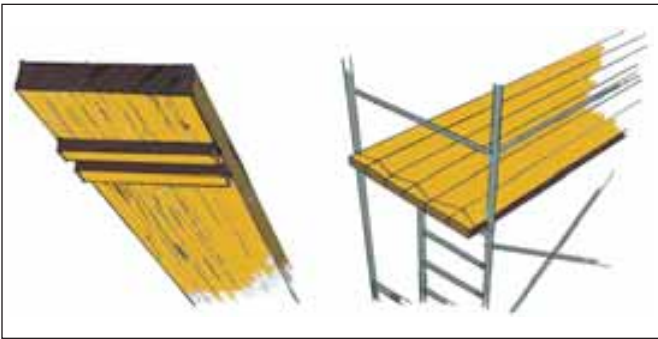


Example of plank placement for dressed scaffold planks (doubled).

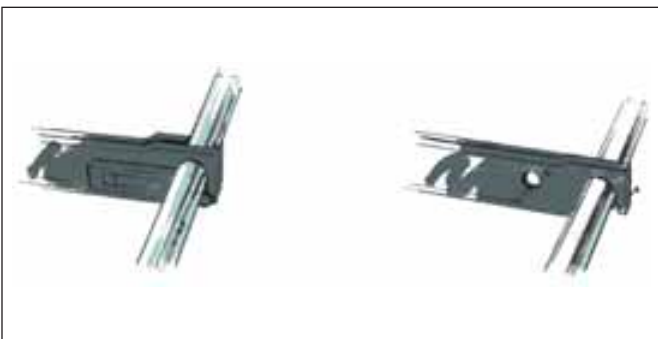




Scaffold planks must extend a minimum of 150 mm (6 in.) and a maximum of 300 mm (12 in.) beyond their support.



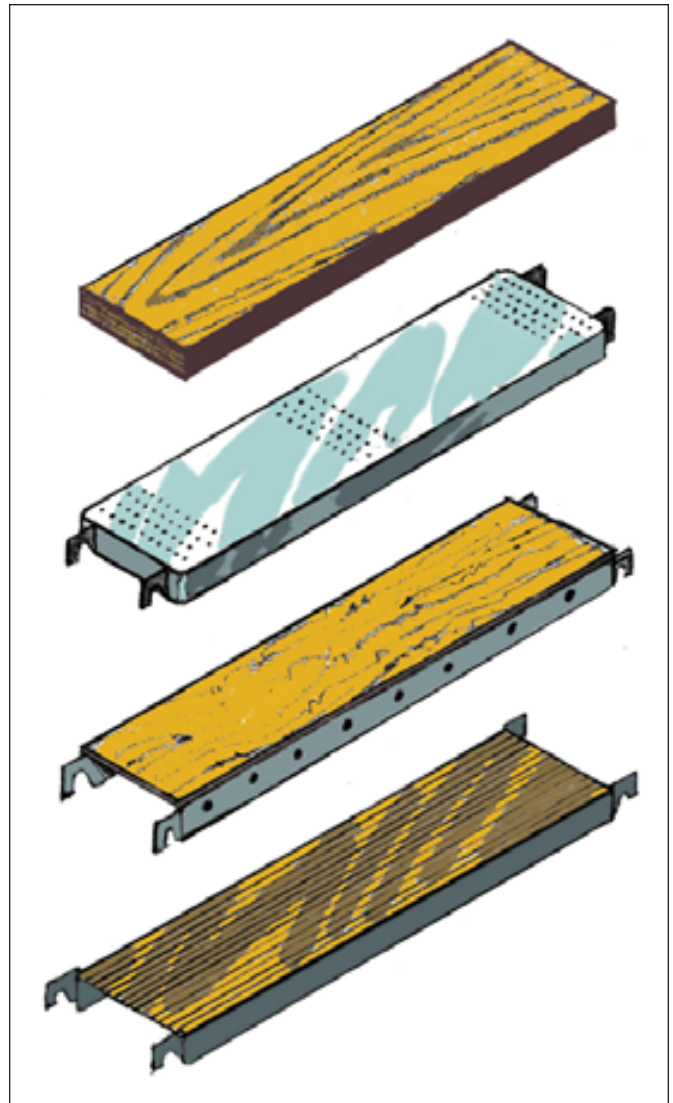
Scaffold planks must be held in place if there is a danger of the planks slipping off their support.



Securing devices for aluminum/plywood platforms.

Manufactured planks

- Manufactured scaffold planks are available in various lengths and duty ratings. These planks must be installed and used according to the manufacturer's and/or supplier's specifications.



These are examples of the various types of manufactured planks.

Ramps and platforms



The slope of work platforms must not exceed 1 vertical to 5 horizontal. Sloped work platforms must have cleats spaced no more than 400 mm (16 in.) apart or a non-skid surface.

Other types of scaffolds

Ladder-jack scaffolds

- All ladder-jack scaffolds must:
 - Be of a manufactured type acceptable to WorkSafeBC
 - Be used only on heavy-duty ladders (with a maximum length of 6 m or 20 ft.), which meet the requirements of the standards listed in the Occupational Health and Safety Regulation
 - Be used only for light-duty operations such as painting and siding installation where the work period between changes of scaffold position is of short duration
 - Not be used by more than two workers on a single scaffold at any one time
 - Have supporting ladders firmly secured against displacement
- Ladder-jack scaffold staging must:
 - Be not less than 38 mm x 235 mm (2 in. x 10 in. nominal) dimensions, supported at intervals not exceeding 3 m (10 ft.) if **solid planks** are used
 - Be not less than 300 mm (12 in.) in width, supported at intervals not exceeding 7.3 m (24 ft.) if **manufactured staging** is used
 - Not incorporate extension staging

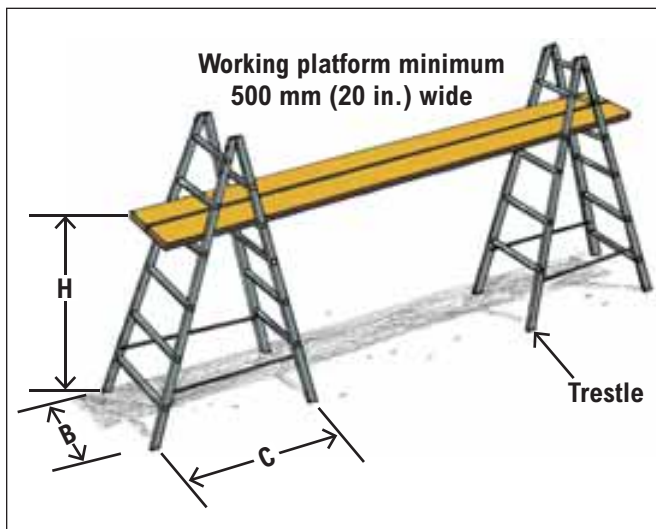
- Ladder-jack safe work procedures:
 - Each worker working off a ladder-jack scaffold which is 3 m (10 ft.) or more above grade must use a fall arrest system (see page 28), such as a harness attached to a firmly anchored lifeline. The anchor must meet the requirement for fall arrest and be capable of supporting a load of 22 kN (5000 lb.).



Fall protection is required on ladder-jacks over 3 m (10 ft.).

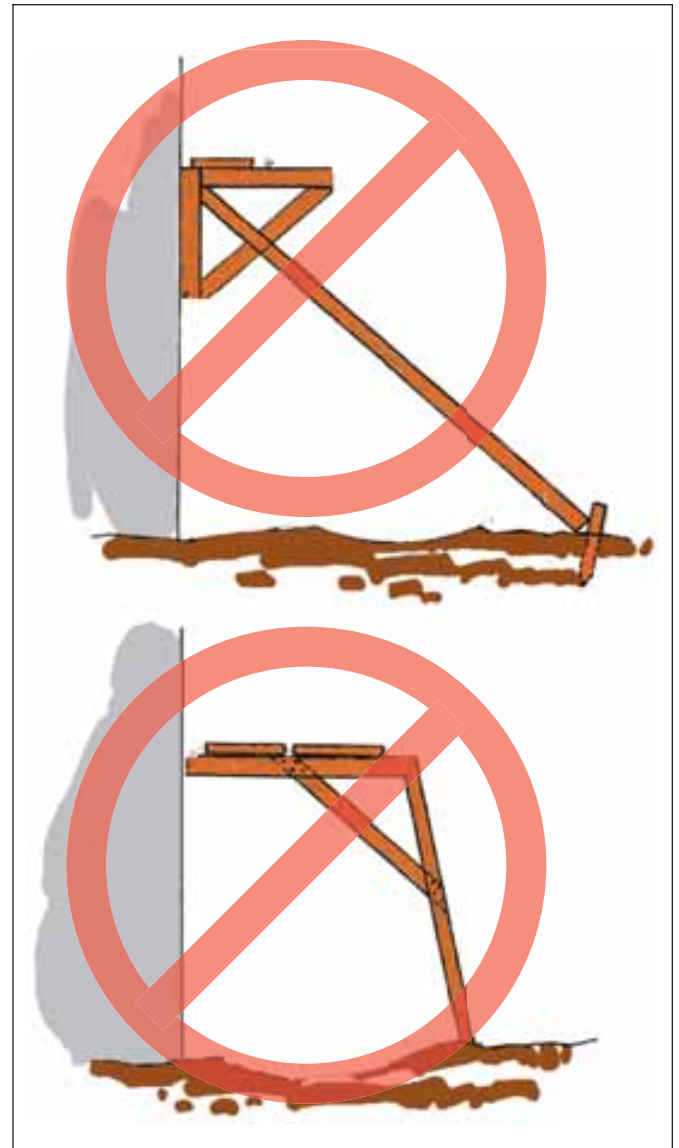
Trestle scaffolds

- Trestle scaffolds can only be used for light-duty work.
- Extensions must not be added to the trestle legs.
- The height of trestle work platform (H) must not exceed three times base dimension (B) of the trestle.
- The spread of trestle legs (C) must be equal to one-half the height of the trestle.
- Stepladders must not be used for trestle scaffolds.



This is an example of a trestle scaffold.

Shore and lean-to scaffolds



The use of shore scaffolds (top) or lean-to scaffolds (bottom) is PROHIBITED.

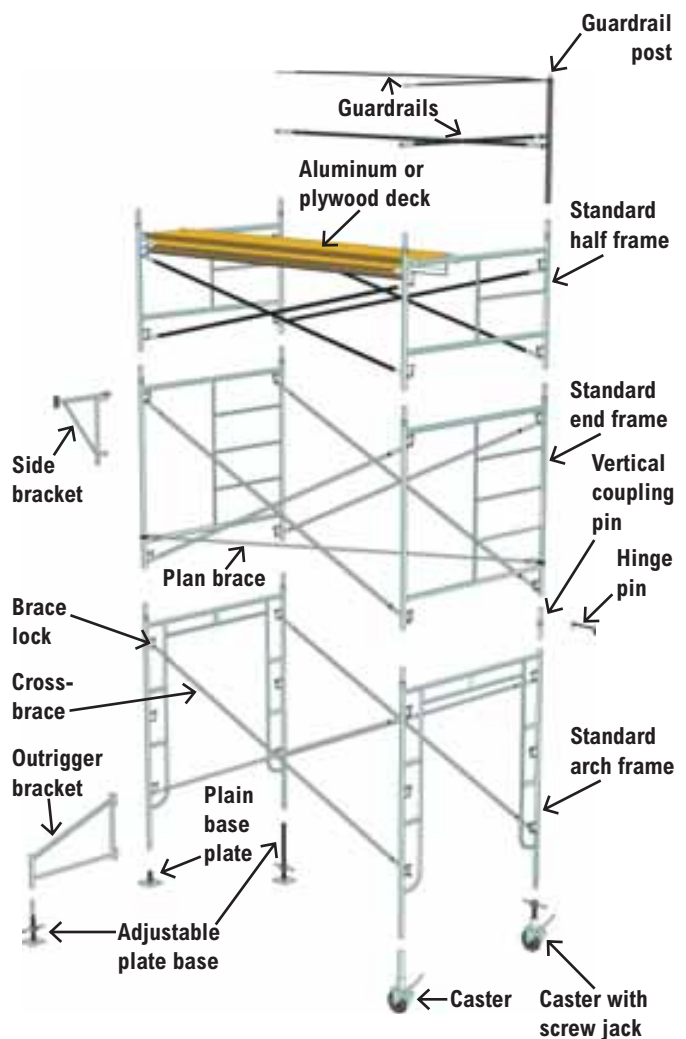
Rolling scaffolds

- The floor or surface on which a rolling scaffold is moved
 - Must be within three degrees of level
 - Must be free from pits, holes, depressions, or obstructions, and
 - Must be able to withstand the superimposed point loading of the casters supporting the scaffold structure and the workers.
- No worker is to remain on a rolling scaffold, while moving it with his own efforts, if the working platform height exceeds $1\frac{1}{2}$ times the scaffold minimum base dimension.



Rolling scaffold

- No worker is to remain on a rolling scaffold while it is being moved by other workers if the working platform height exceeds twice the minimum base dimension.
- At least two of the four wheels on rolling scaffolds must be the swivel caster type. The caster height adjusting pins or screws must be installed so that the casters cannot fall out of the supporting legs of the scaffold.
- The wheels of rolling scaffolds must have locking devices.



Scaffold parts

EQUIPMENT SAFETY



Ladders

Ladders of all types are used extensively in residential construction. Workers' Compensation Board statistics show that falls, including those from ladders, are one of the highest causes of injury in this industry.

Requirements for safe ladder use

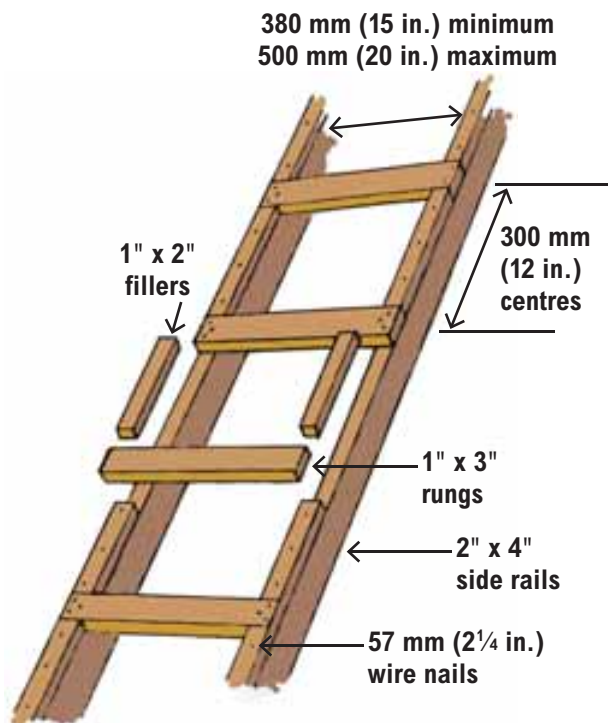
- Ladders should be inspected before use. Ladders with loose, broken, or missing rungs, split or bent side rails or other defects, must be removed from service.
- The base of a ladder's side rails must rest on a firm, level foundation. Non-self-supporting ladders (straight ladders) need to have non-slip bases or spikes, depending on the terrain. Such safety devices need to be maintained in good condition.
- The top of ladders must rest against a bearing surface of sufficient strength that will not deform under load or shatter (in the case of glass or similar material).
- When in use, portable ladders other than stepladders must be placed using a maximum 4 vertical to 1 horizontal ladder slope (see illustration on page 50).
- Portable ladders other than stepladders must be of sufficient length to project approximately 1 m (3 ft.) above the upper landing to which it provides access.
- Ladders must be tied, blocked, or otherwise secured to prevent them from slipping.
- It's important that the right ladder is chosen for the job. See WorkSafeBC Guideline 13.4 "Ladder ratings and selection" for more information on matching the ladder and the load.
- Aluminum extension ladders must be constructed rated; and when extended, a minimum overlap of 1 m (3 ft.) of the two pieces of ladder must be made.
- Metal ladders or ladders with steel reinforcements must not be used where electrical hazards exist.
- Short sections of ladders must not be spliced together to make longer ladders.
- Ladders should never be used as scaffolding planks.
- If wooden ladders are coated, the coating should be clear.
- Ladders should not be placed in doorways, passageways, or other areas where they might interfere with other work activities.
- Tools and materials must not be carried when climbing ladders. Suitable hoisting equipment must be used for this purpose.
- No worker is permitted to work from the top two rungs of a single or extension ladder or the top two steps of a stepladder unless permitted by the manufacturer.

Job-built ladders

Poorly designed and constructed wooden ladders built on the job site have resulted in serious injuries to construction workers.

Job-constructed wooden ladders must be designed and built to the following WorkSafeBC specifications.

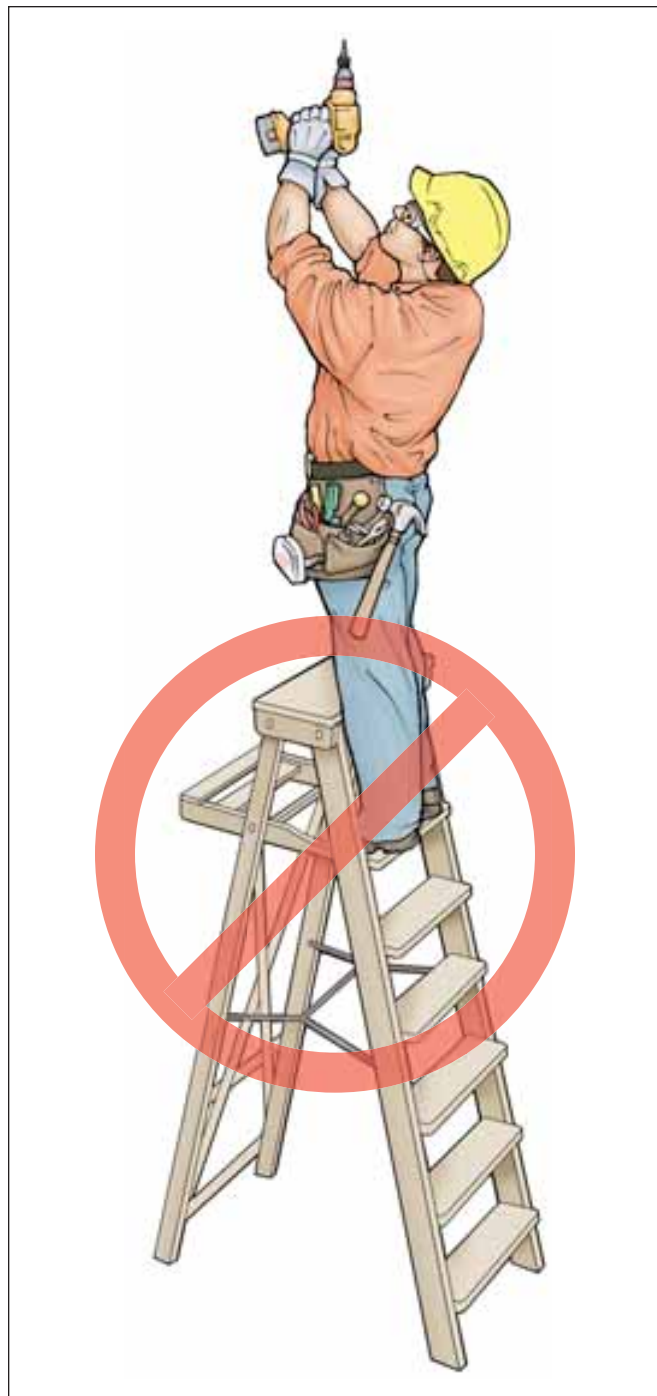
Note: The following specifications shown here are designed for ladders up to a maximum of 5 m (16 ft.) in length.



A job-built ladder up to 5 m (16 ft.) long.

- All ladder components must be cut from lumber free of defects, and must be construction grade or better.
- The side rails must be 38 mm x 89 mm (2 in. x 4 in. nominal) dimensions. Side rails must not be notched, dapped, tapered, or spliced. The distance between the inner faces of side rails must not be less than 380 mm (15 in.) nor more than 500 mm (20 in.).
- The rungs (cleats) must be 19 mm x 64 mm (1 x 3 in. nominal) dimensions. Rungs must be placed at 300 mm (12 in.) centres.
- Rungs must be nailed directly onto the edge of the side rails.

Stepladders



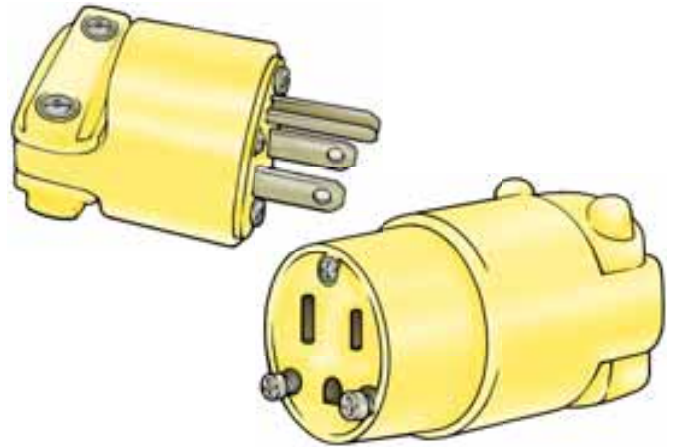
Workers must not work from the top two steps of a stepladder.

Electrical power tools and cords

All electrical equipment should be checked to ensure they are CSA approved. However, use of approved equipment does not eliminate all dangers if the equipment is damaged or is used in adverse conditions, such as in rain or wet areas. Cord-connected portable equipment and supply cords must be maintained in good repair and be suitable for each condition of use. For example, the outer jacket of a cab-tire cord may appear undamaged but may conceal a broken ground conductor. Also, most electrical equipment manufacturers specify that their equipment should not be used in damp or wet conditions. Class A type ground fault circuit interrupters (GFCI) must be used for portable electrical equipment when working outside or in wet or damp conditions.

Safe work procedures

- Inspect tools, power cords, and electrical fittings for damage prior to each use. Repair or replace damaged equipment.
- Switch tools off before connecting to a power supply.
- Disconnect the power supply before making adjustments.
- Make sure tools are either properly grounded or the double-insulated type. Grounded tools must have a 3-wire cord with a 3-prong plug. This plug must be plugged into a properly grounded 3-pole outlet.
- Do not break off the third (ground) prong on a plug.
- Test electrical tools and cords for effective grounding with a continuity tester before use.
- Replace open front plugs with dead front plugs, which are sealed and pose less danger of electric shock or short circuit (see above diagram).
- Do not bypass the tool ON/OFF switch by connecting and disconnecting the power cord.
- Suspend power cords over walkways or working areas wherever possible to eliminate tripping hazards.
- Do not use extension cords as permanent wiring. They must only be used to temporarily supply power to an area that does not have a power outlet.
- Do not allow vehicles or equipment to pass over unprotected power cords. Cords should be put in electrical conduit or protected by placing them between two pieces of lumber of suitable strength.
- Keep power cords away from heat, water, and oil.



Extension cord plugs must not have an open front, and must be a three-prong type.

-
- Do not use light-duty power cords for heavy load applications.
 - Do not carry electrical tools by the power cord.
 - Do not disconnect the power supply by pulling or jerking the cord from the outlet. Pulling the cord rather than the plug may result in electric shock.
 - Do not tie knots in power cords. Knots can cause short circuits and electric shocks. Loop the cords or use a twist lock plug.
 - Do not clean tools with flammable solvents.
 - Do not operate electrical tools in an area containing high levels of explosive vapours or gases.
 - Do not overload the circuit by plugging several power cords into one outlet.

Hand tool ergonomics

Powered and non-powered hand tools are widespread in the construction industry. Along with common injuries such as cuts and bruises, a large number of strains and sprains or soft tissue injuries are also related to frequent and prolonged use of hand tools. Prevention of soft tissue injuries is a priority for WorkSafeBC. The proper selection and design of hand tools is important to reduce the number of strains and sprains or soft tissue injuries.

Factors affecting tool use

Several factors can affect your health and performance when using tools:

- Duration of tool use – static effort or load occurs when muscles are kept tense and motionless for prolonged periods of time.
- Awkward working positions – occasionally, there may be jobs that are difficult to access or where there is limited space.
- Weight of the tool – heavier tools demand more effort to operate. With a corresponding increased demand for more cordless tools, larger and heavier batteries are required.
- Vibration – certain tools such as chipping hammers, grinders, and certain percussive tools can produce significant levels of vibration.
- Shock reaction – sudden changes in torque from a tool can occur when, for example, the drill bit penetrates the work piece.
- Repetition – if the same muscles are used repeatedly or for long periods of time to operate a tool, your chance of soreness or injury increases.

Reducing risk of injury

Keep the following suggestions in mind when selecting and using tools:

- Fits the job you are doing – selecting the right tool is very important.
- Fits the space available – pick a tool that fits your workspace.
- Reduces the force you need to apply – for jobs needing higher torques, consider ratchet tools to minimize the torque on your wrist.
- Fits your hand – select tools that you can comfortably grasp.
- Has comfortable handles – a good handle protects your hand from contact with the tool surface.
- Is not too heavy – as a general rule, tools heavier than 2.5 kg should be suspended.
- Is properly maintained – blunt or dull tools such as saws, cutters, screwdriver tips, or any tool in a poor state of repair can compromise your safety and increase the effort needed to operate them.

Compressed air for cleaning

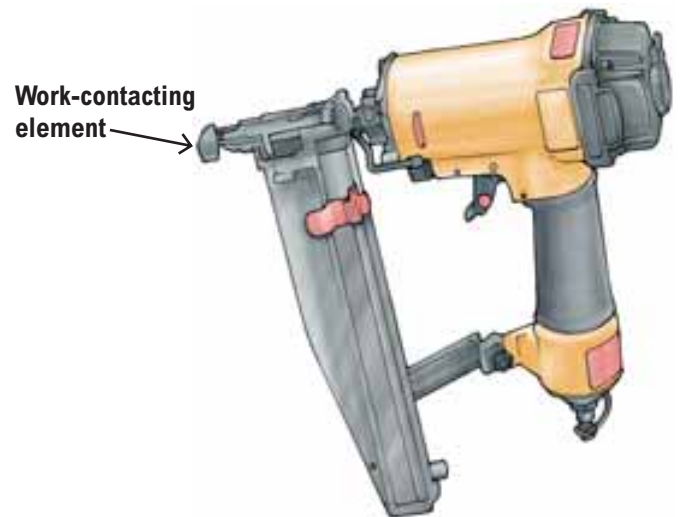


*Do not use compressed air to blow dust or debris from your clothing.
Air can be forced through your skin into blood vessels.*

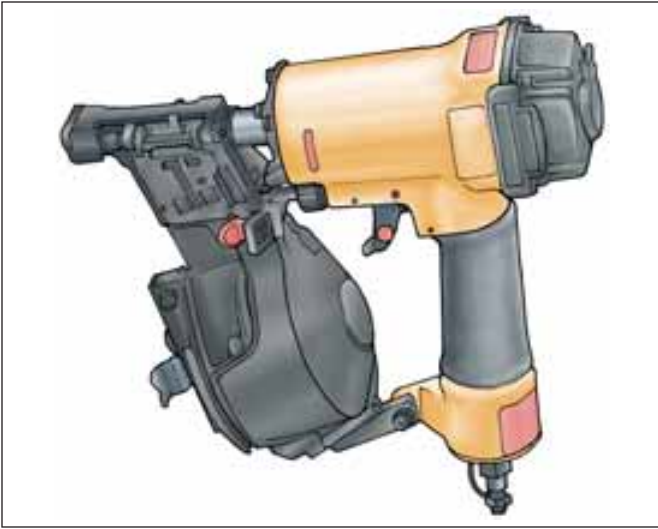
Pneumatic nailing and stapling equipment

Safe work procedures

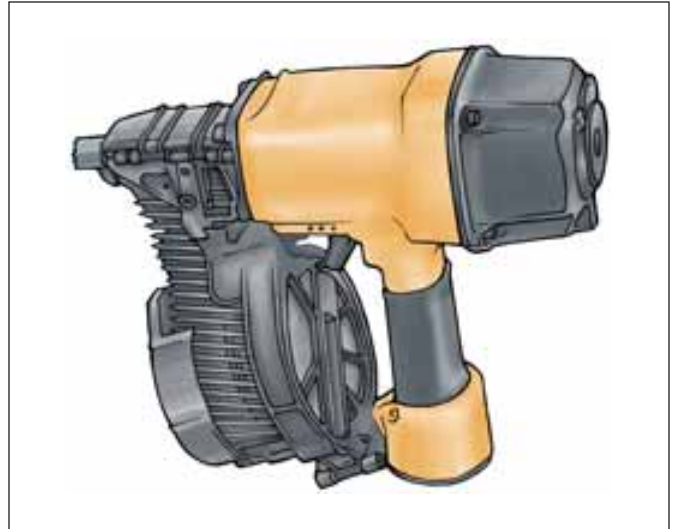
- Permit only trained and experienced workers to operate pneumatic nailing and stapling tools.
- Wear proper eye and hearing protection.
- Make sure the tool is maintained in safe operating condition.
- Inspect the tool before connecting to the air supply:
 - Check safety mechanisms if applicable.
 - Ensure that screws and cylinder caps are securely tightened.
 - Make sure the air pressure is as specified by the manufacturer of the tool.
- Before using, check that the tool is properly connected to the air supply and is in working order, with the safety mechanism operable.
- Do not operate the tool at air pressures above the manufacturer's specifications.
- Always handle the tool as if it contains fasteners.
- Always use a work-contacting element that limits the contact area to one as small as practicable.
- Make sure the mechanical linkage between the work-contacting element and trigger is enclosed.
- Disconnect the tool from the air supply and exhaust all air from the tool by squeezing the trigger when:
 - Not in use
 - Cleaning or adjusting
 - Clearing a blockage
- Only use fasteners recommended by the manufacturer of the tool, and when reloading follow the manufacturer's instructions.
- Do not point the tool at yourself or any other person.
- Do not squeeze the trigger unless the nosepiece of the tool is directed at a safe work surface.
- Do not transport or load the tool with your finger on the trigger.
- Do not secure the trigger in the ON position.
- Do not overreach when using the tool.
- Ensure you have the right amount of air pressure for the size and type of nail you are using (caution: too much pressure can cause a nail to go right through the material and could cause a serious injury to other workers)
- Follow the manufacturer's safe operating procedures when using nailers powered by butane.



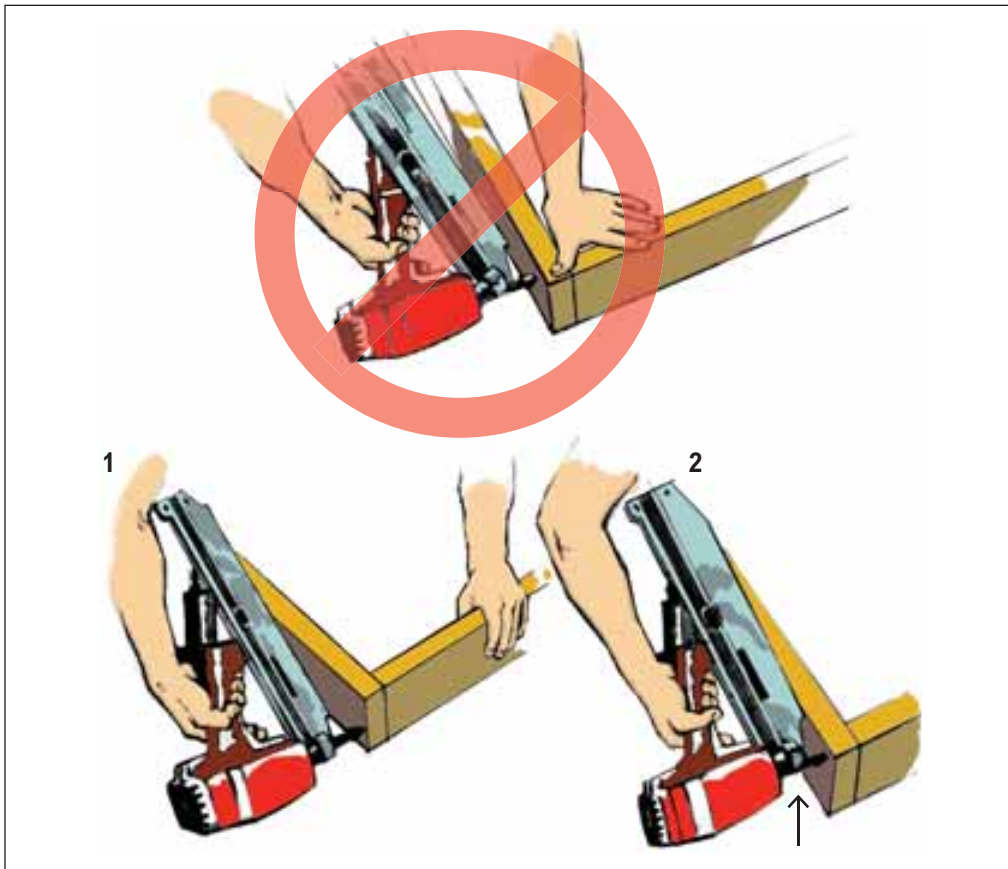
Pneumatic nailer straight feed



Pneumatic nailer and staple gun with coil feed



Butane-operated nailer gun with coil feed



These two diagrams show the safe sequence for using an air nailer.

Power tools—saws

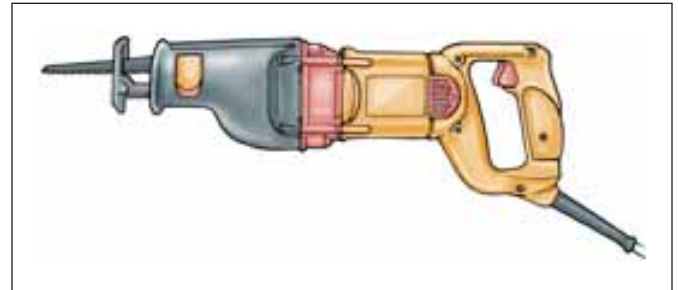
The following saws are commonly used in house construction: circular saw, quick cut saw (cut off), sabre saw (reciprocating), chain saw, chop saw, radial arm saw, and table saw.

Basic safety

- Wear the appropriate protective clothing at all times when operating a saw, especially eye protection.



Battery-operated reciprocating saw

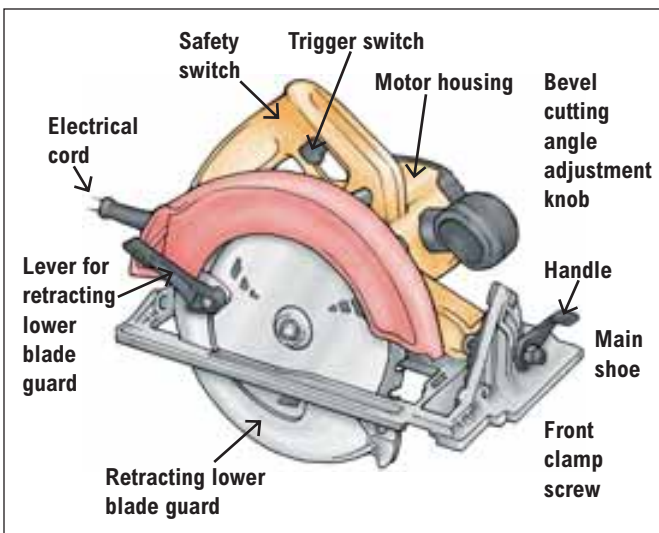


Electrically operated reciprocating saw

- When ventilation is poor, wear a suitable dust mask. Exposure to dust from materials such as particle board or medium density fibre (MDF) board may cause health problems.
- When using saws for long periods of time, especially in a confined space, wear hearing protection.
- Use a ground fault circuit interrupter for all electrically operated tools.
- Disconnect the power source on all tools before making any changes or adjustments.
- Never put hand tools down on a bench or on the floor while the blade is still moving.
- When using hand-held saws:
 - Keep hands away from the rotating blade; wet lumber, plywood, or wood with a twisting grain can cause binding and kick back of the blade.
 - Rest or clamp wood to a bench or sawhorse on a stable footing; make sure you have a firm grip on the wood being cut.
 - Always use the right blade for the material you are cutting; ensure that it is sharp and installed correctly.
- When using a sabre saw (reciprocating), caution should be exercised when cutting near electrical wiring, copper or plastic piping.

- Only persons trained in the operation, care, and maintenance of the quick cut saw should use it, because it is a powerful machine. When operating the saw, always have both hands holding the saw and be on a firm footing. Some of the hazards include, but are not limited to
 - High-speed blade rotation and exposure during operation
 - Exhaust fumes from combustion engine
 - Dust when dry cutting concrete or masonry
 - Showers of hot sparks when cutting sheet metal or solid steel
- Quick cut saws are generally gas-operated machines. When re-fueling, shut off the engine; ensure that this is carried out in a well-ventilated area, preferably outside. Any gas spills must be cleaned up immediately to ensure the vapors cannot come into contact with any form of ignition.

Portable circular saws

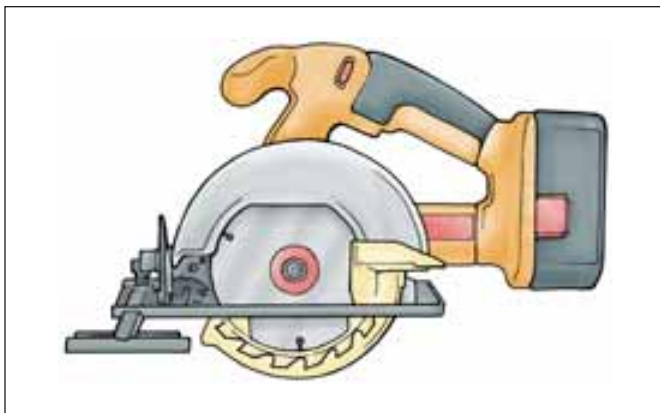


Electrically operated portable circular saw

Safe work procedures

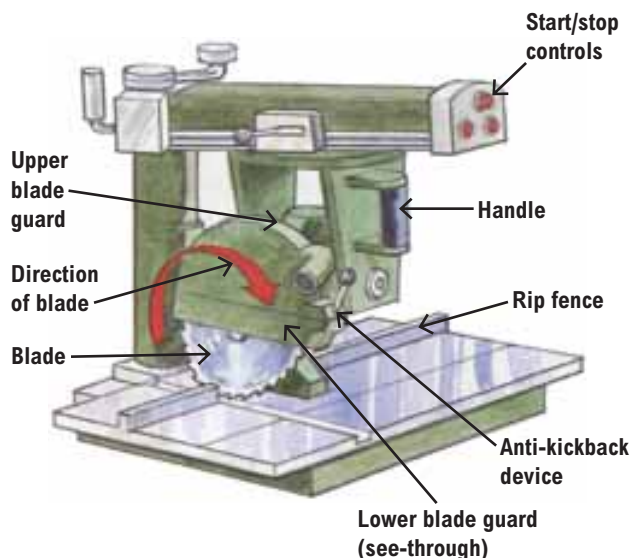
- Permit only trained and experienced workers to operate a saw.
- Wear proper eye and hearing protection, and when required, respiratory protection.
- Use sharp blades designed for your work and recommended by the tool manufacturer.
- Check the retractable lower blade guard before use, to make certain that it works correctly.
- Allow the saw to reach full power before cutting.
- Make sure the lower blade guard is fully returned before laying down the saw.
- Disconnect the power supply before adjusting or changing the blade.
- Keep all electrical cords clear of the cutting path.
- Use both hands to operate the saw.
- Keep the saw blade guards and motor clean and free of sawdust.
- Secure the work while cutting.
- Do not fix or hold the retractable lower blade guard in the open position.
- Do not place your hand under the shoe or guard of the saw while the saw is connected to the power supply.
- Do not overtighten the saw blade locking nut.
- Do not twist the saw while cutting to change direction or saw alignment unless the blade is designed for that purpose.
- Do not use a saw that vibrates or is defective.

- Do not force the saw during cutting.
- Do not cut materials without first checking for obstructions or foreign objects such as nails and screws in the cutting path of the saw.
- Do not carry portable circular saws with hands or fingers on the trigger switch.



Battery-operated portable circular saw

Radial arm saws

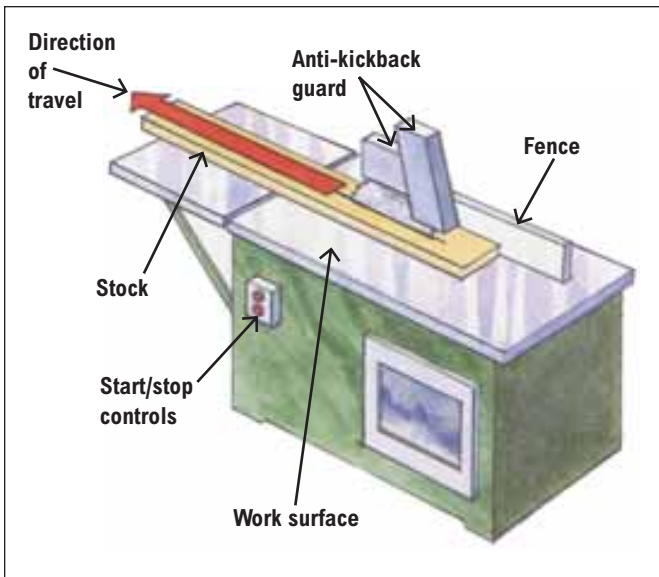


Safe work procedures

- Wear proper eye and hearing protection, and when required, respiratory protection.
- A radial arm saw cutting table must be of sufficient width so that no part of the saw blade overhangs the forward edge of the table. A stop may also be used to limit forward travel of the saw to prevent overhang.
- Saws must not be operated at speeds in excess of the manufacturer's recommendation.
- Only use accessories designed for the saw and recommended by the manufacturer.
- Make sure the blade guard is in place and properly adjusted.
- Stand on the handle side of the saw when cross cutting.
- Return the saw blade to behind the fence after each cut.
- Make sure the overall length of the saw table (both infeed and outfeed) is twice the length of the lumber being cut.
- Make sure during ripping that material is fed counter to the saw blade rotation.
- The motor head must be locked into position at the correct height and desired angle.
- Clamp stock to the table when making mitre, bevel, or compound mitre cuts. This overcomes the tendency of the stock to slide along the fence.
- Turn off the saw and unplug the electrical cord when making changes.

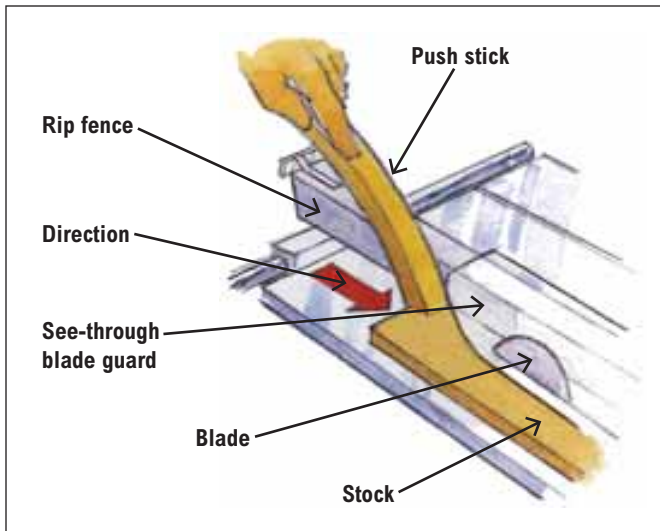
- When it is necessary to measure stock on the cutting table, the saw must be turned off until measuring is complete.
- Do not use radial arm saws for ripping unless spreader and anti-kickback devices are used.
- During operation, do not remove your hand from the operating handle, unless the cutting head is behind the fence.
- Do not remove stock from the cutting table until the saw blade has been returned to its position behind the fence.
- Do not cut “free-hand.” The material to be cut must lie solidly on the cutting table against the back guide.
- Do not use any circular saw blade having a crack exceeding $\frac{1}{10}$ of the saw diameter or any circular saw blade with cracks adjacent to the collar line.

Table saws



Safe work procedures

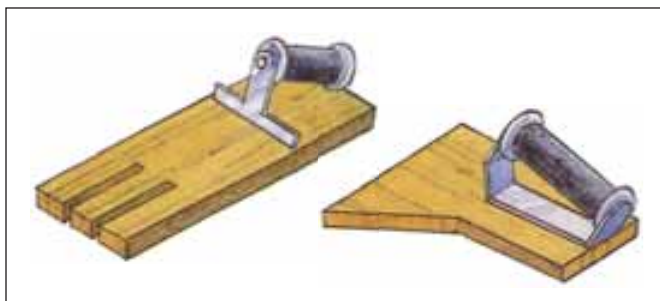
- Wear proper eye and hearing protection, and when required, respiratory protection.
- Refer to and follow the table saw manufacturer's instructions for reducing the risk of kickback.
- Permit only trained and experienced workers to operate the saw.
- Make sure the guard is in place and working correctly.
- Choose the proper saw blade for the type of work being done.
- Keep saw blades clean, sharp, and properly set so they will cut freely without being forced.
- Keep the work area clean. Operate the table saw in a non-congested, well-lighted area.
- Feed material into the saw blade counter to the direction of rotation.
- During cutting, keep hands out of the line of the saw cut.
- Use the saw blade guard with a spreader and anti-kickback fingers for ripping or cross cutting operations.
- Keep your body to the side of the saw blade out of the line of a possible kickback.
- Use a push stick when ripping narrow stock.



Simple push stick useful on table saw when distance between the blade and fence is narrow

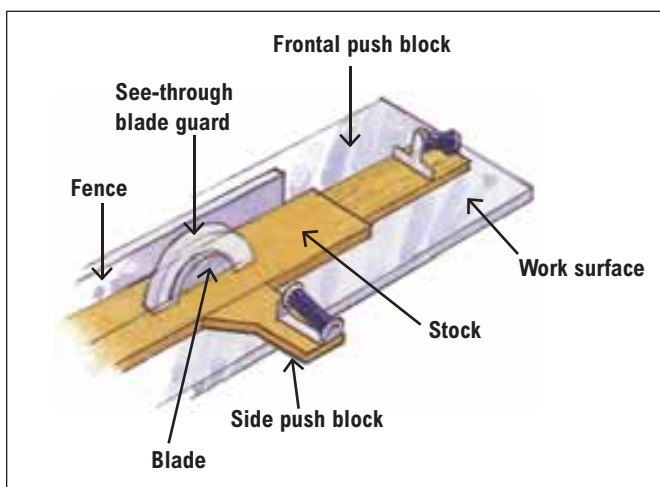


- When changing the saw blade:
 1. Stop the machine
 2. Disconnect the power supply
 3. Place the plug end of the cord on top of the saw table
 4. Replace the saw blade
- Do not perform free-hand sawing. The stock must be held firmly against the mitre gauge or rip fence to position and guide the cut.
- Do not reach around or over a moving saw blade.
- Do not leave the table saw unattended while the saw blade is in motion.

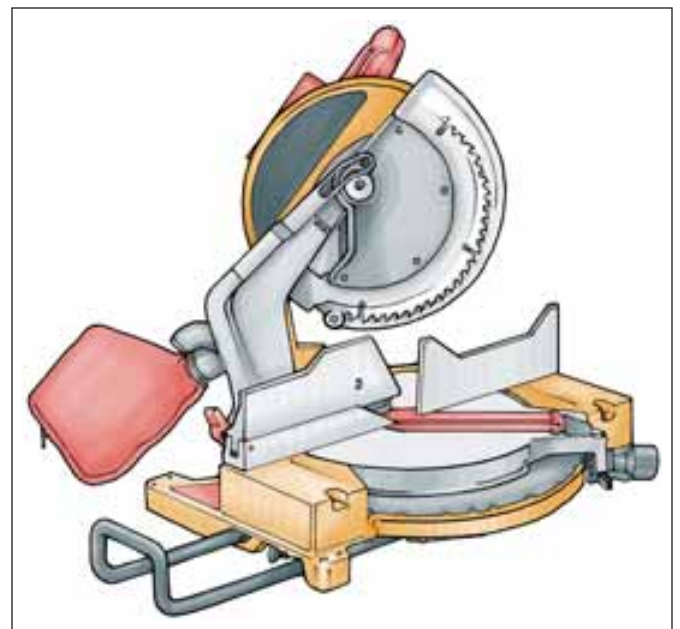


Frontal push block

Side push block



Use of two push blocks on single application

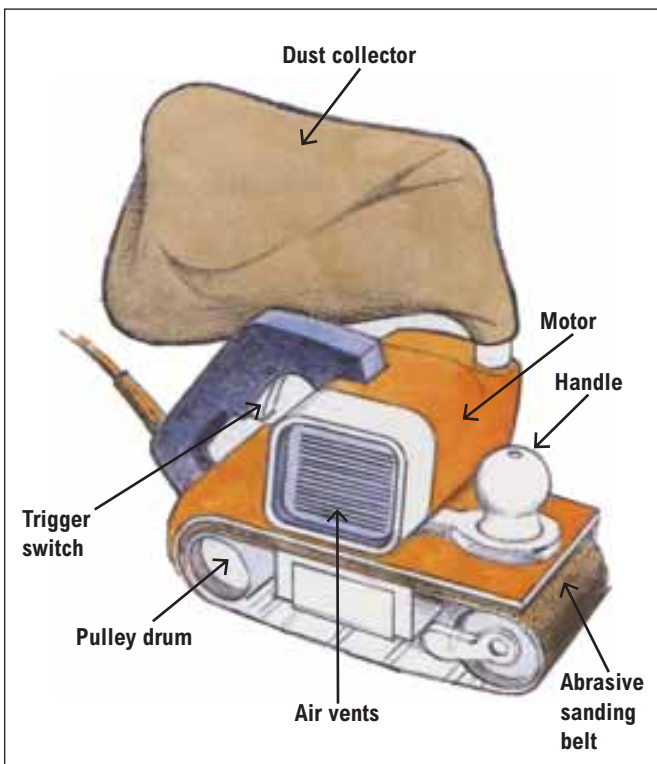


Electrically operated mitre saw

Other electrically operated tools

- When operating screw guns, extra care must be taken when changing drill bits to avoid contact with the power source. To avoid constant twisting of the wrist, set the right torque for the size of screw.
- When using large hammer drills to drill horizontally above the waistline or upward, special care is needed. The drill bits can jam, and the torque on the drill can cause severe twisting of the wrist.
- When using any type of drill or screw gun, safety glasses must be worn at all times; and in some cases, a full face shield may be required.

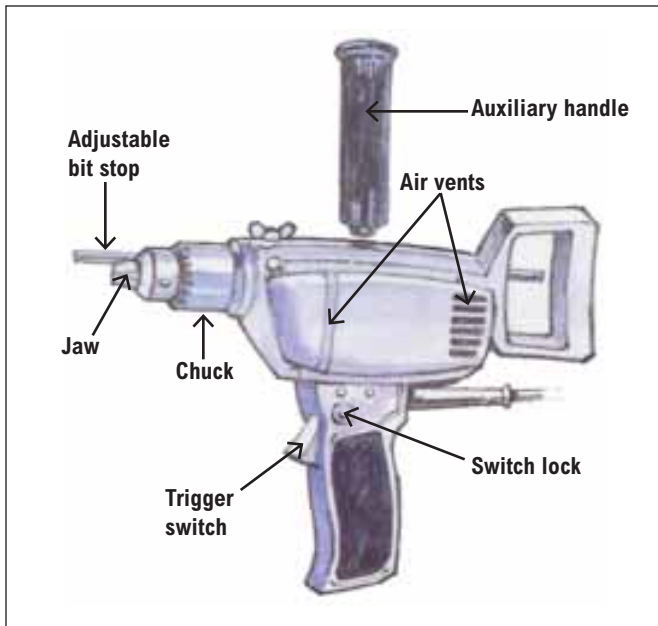
Powered hand belt sander



Safe work procedures

- Wear proper eye and hearing protection, and when required, respiratory protection.
- Disconnect the power supply before changing the sanding belt, making adjustments, or emptying the dust collector.
- Use sanding belts that are the same width as the pulley drum.
- Make sure the sanding belt is installed in the direction indicated on the belt and sander.
- Inspect sanding belts before using them. Replace worn or frayed belts.
- Keep hands away from the sanding belt. Use both hands to operate the sander, one on the trigger switch and the other on the front knob handle.
- Keep all cords clear of the sanding area during operation.
- Clean dust from the motor and vents at regular intervals.
- Do not exert excessive pressure upon the moving sander.
- Do not use a sander without an exhaust system or dust collector. Empty the collector when $\frac{1}{4}$ full.
- Do not work on unsecured material that can be thrown by belt motion. Secure the material or use a stop block.

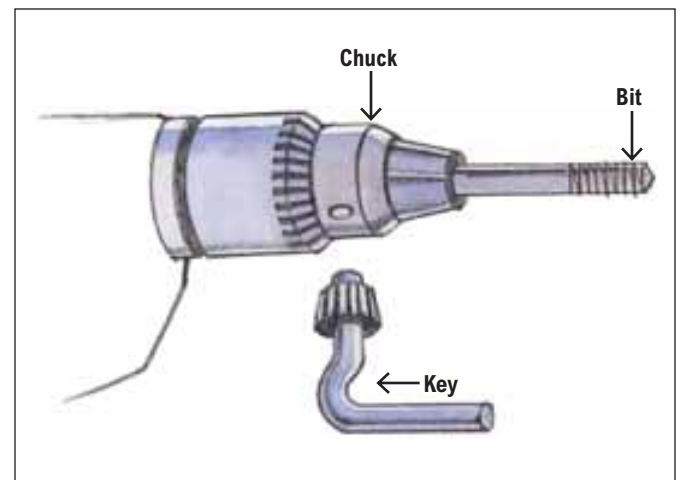
Powered hand drills



Battery operated power drill

Safe work procedures

- Wear proper eye and hearing protection.
- Keep drill vents clear to maintain adequate drill ventilation.
- Keep drill bits sharp at all times.
- Keep electrical cords clear of the drilling area.
- Secure the material being drilled to prevent movement.
- Slow the rate of feed before breaking through the surface.
- Drill a small pilot hole before drilling large holes.
- Disconnect the power supply before changing or adjusting the drill bit or other attachments.
- Remove the chuck key before connecting the drill to the power supply.



-
- Do not use a bent or damaged drill bit.
 - Do not exceed the manufacturer's recommended maximum drilling capacities.
 - Do not use high speed steel bits without cooling or lubrication.
 - Do not reach under or around material being drilled.
 - Do not overreach. Keep proper footing and balance at all times.
 - Do not drill with one hand while holding the material with the other.

- Hold the saw securely with both hands with fingers and thumb around the handles. This grip helps prevent the hands being dislodged and provides control in the event of a kickback.

Safe work procedures

- Don't operate the saw when you are tired.
- Know where the bar tip is at all times.
- Don't allow the cut to bind (close) on the saw chain.
- Make sure the chain brake is functioning.

Chain saws for construction

- Chain saws used for construction must be equipped with a chain break and with anti-kickback chain.
- Whether a chain saw is electric- or gasoline-powered, operators must follow the manufacturer's recommended safe operating procedures.
- Never walk around with a saw in the operating mode. Switch off the power source.
- Do not attempt to cut anything other than wood with a chainsaw.
- When operating a chain saw, safety goggles and hearing protection must be worn at all times.
- Trousers or chaps, with ballistic nylon pads sewn in, will provide protection to the legs.

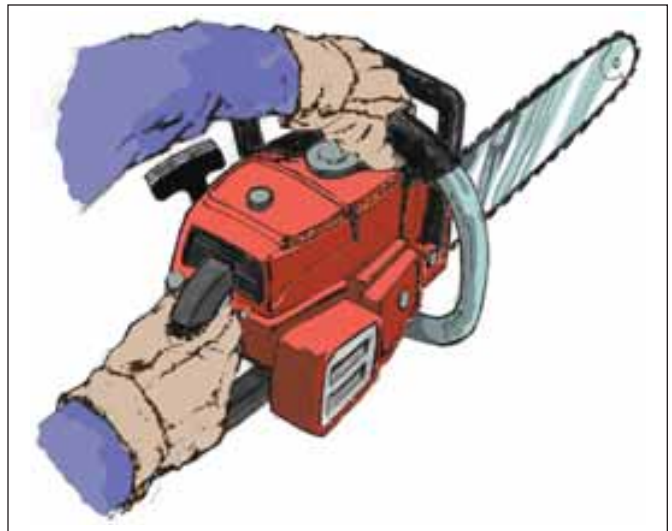
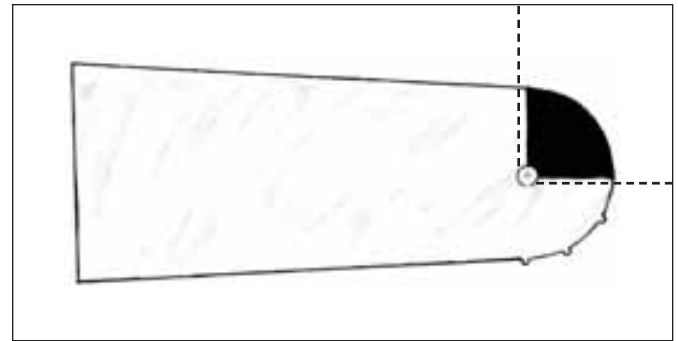


Diagram showing proper grip of a chain saw

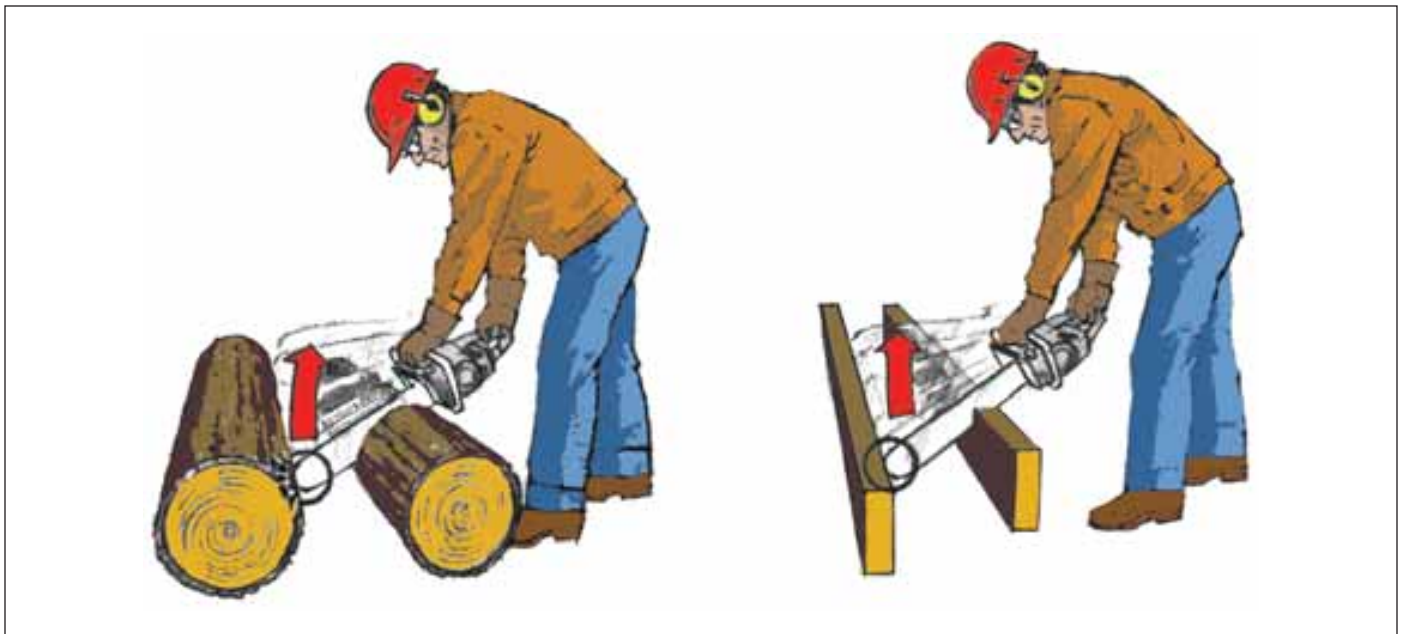
Kickback

The most common and usually most violent kickback occurs when contact is made in the “kickback” zone.

Contact in this zone makes the chain bunch up and try to climb out of the cutting track. This often happens when the saw tip makes contact with something beyond the cutting area, such as a tree branch, a log, or planks.



Make sure to avoid contact in the kickback zone (shown in black).



The above examples show how kickback can occur.

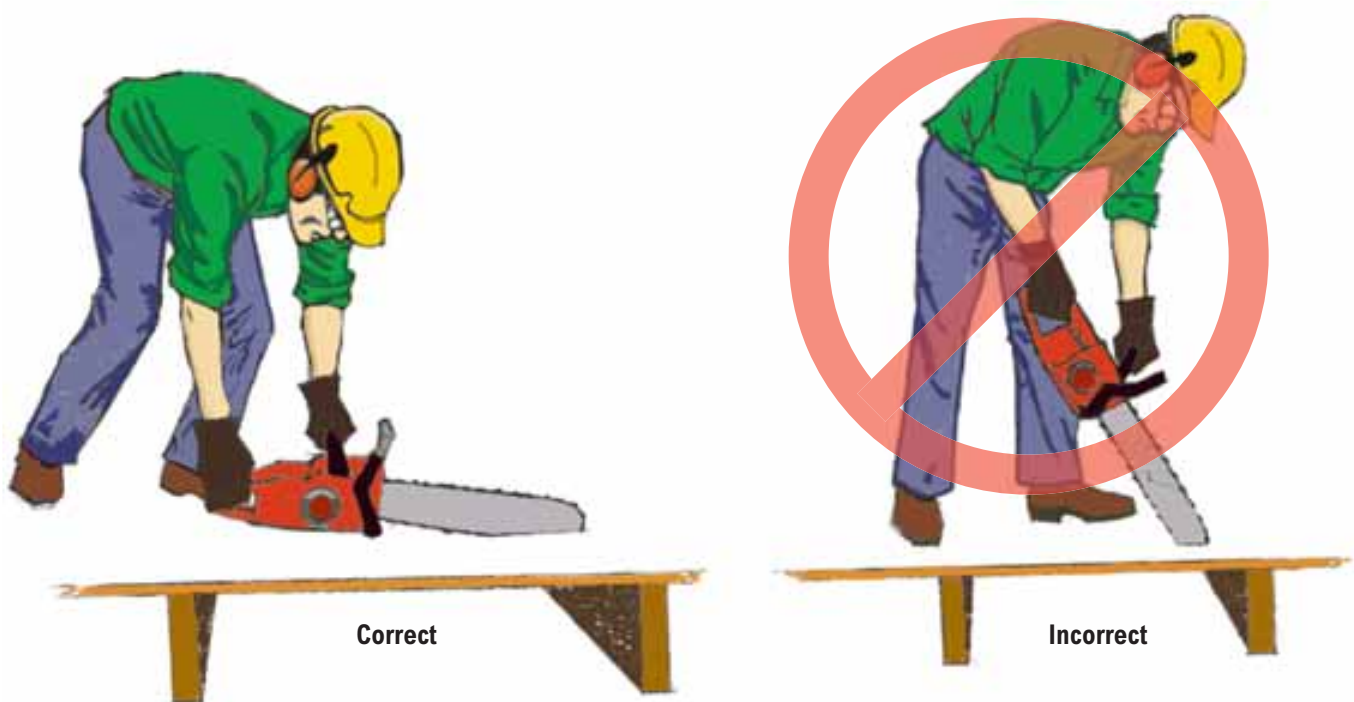
Construction site hazards

Many of the hazards in falling and bucking trees will also be encountered by workers cutting dressed lumber or timbers on a residential construction job site.

Safe work procedures

- Take extra care when making pocket cuts. Start the cut with the underside of the chain tip, then work the saw down and back to avoid contact with the kickback zone. Consider the use of a sabre (reciprocating) saw to make pocket cuts.

- Be particularly careful to avoid contact with nails, piping, or other objects. This is especially important when making a pocket cut through framing lumber such as a subfloor or when cutting used lumber such as shoring, lagging, or blocking timbers.



Propane safety

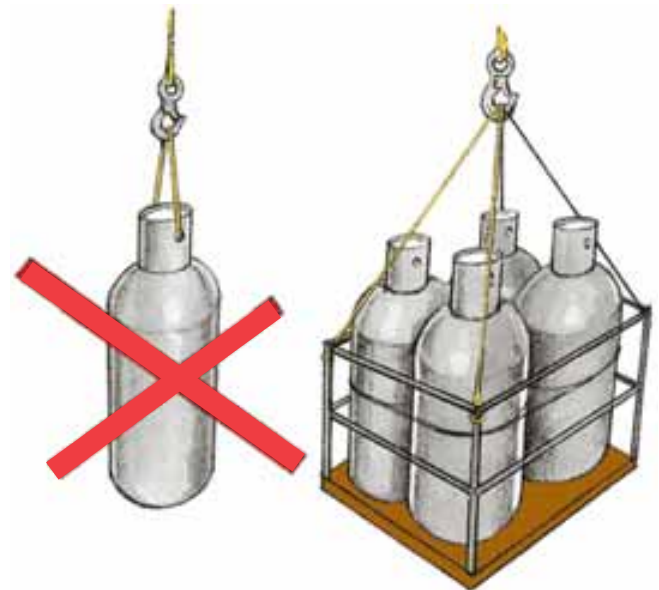
Propane leaks can cause serious fires and explosions. Propane gas, which is heavier than air, may leak and accumulate to create a dangerous environment, as it tends to creep along the ground and collect in low spots.

Propane space heaters

- When using propane space heaters, do not close up a house tightly. Good ventilation is necessary to remove moisture and to prevent a build-up of propane gas.
- Do not use propane heaters anywhere where spray painting of flammable paints is being done.
- Cylinders that are not being used should be stored outdoors.
- Prior to use, propane hoses must be:
 - Checked for damage and replaced if necessary
 - Protected from traffic damage
 - Checked for leaks at their connections (use a liquid soap test – bubbles will appear if a leak is present)
- When using tar kettles or tankers, propane cylinders must be kept at least 3 m (10 ft.) away.
- Propane cylinder valves must be fully opened when in use and tightly closed when not in use. Cylinder valves must not be used to adjust the torch flame. Pressure regulators are used for this purpose.
- Before shutting off the burner, close the cylinder valve and let the remaining gas burn out of the hose before closing the burner valve.

General propane safety

- Check propane cylinders for damage or corrosion prior to use.
- All propane and burner systems must be provided with a functional regulator.
- Propane cylinders must be secured in a level, upright position during storage, transportation, and use.
- Never apply a flame to cylinders to increase their pressure.
- Do not operate any equipment if the odour (rotten egg smell) of propane is present.
- Do not hoist propane cylinders by their valves or collars.



In the event of a propane fire

- Shut off the propane gas valve if safe to do so.
- Evacuate the area.
- If the propane gas flow cannot be shut off safely:
 - Allow the propane gas to burn
 - Evacuate the area and immediately call the fire department

WorkSafeBC Offices

Visit our web site at WorkSafeBC.com.

Abbotsford

2774 Trethewey Street V2T 3R1
Phone 604 276-3100
1 800 292-2219
Fax 604 556-2077

Burnaby

450 – 6450 Roberts Street V5G 4E1
Phone 604 276-3100
1 888 621-7233
Fax 604 232-5950

Coquitlam

104 – 3020 Lincoln Avenue V3B 6B4
Phone 604 276-3100
1 888 967-5377
Fax 604 232-1946

Courtenay

801 30th Street V9N 8G6
Phone 250 334-8765
1 800 663-7921
Fax 250 334-8757

Kamloops

321 Battle Street V2C 6P1
Phone 250 371-6003
1 800 663-3935
Fax 250 371-6031

Kelowna

110 – 2045 Enterprise Way V1Y 9T5
Phone 250 717-4313
1 888 922-4466
Fax 250 717-4380

Nanaimo

4980 Wills Road V9T 6C6
Phone 250 751-8040
1 800 663-7382
Fax 250 751-8046

Nelson

524 Kootenay Street V1L 6B4
Phone 250 352-2824
1 800 663-4962
Fax 250 352-1816

North Vancouver

400 – 224 Esplanade Ave. W. V7M 1A4
Phone 604 276-3100
1 888 875-6999
Fax 604 232-1558

Prince George

1066 Vancouver Street V2L 5M4
Phone 250 561-3700
1 800 663-6623
Fax 250 561-3710

Surrey

100 – 5500 152 Street V3S 5J9
Phone 604 276-3100
1 888 621-7233
Fax 604 232-7077

Terrace

4450 Lakelse Avenue V8G 1P2
Phone 250 615-6605
1 800 663-3871
Fax 250 615-6633

Victoria

4514 Chatterton Way V8X 5H2
Phone 250 881-3418
1 800 663-7593
Fax 250 881-3482

Head Office / Richmond

Prevention Information Line:

Phone 604 276-3100
1 888 621-7233 (621-SAFE)

Administration:

6951 Westminster Highway
Phone 604 273-2266

Mailing Address:

PO Box 5350 Stn Terminal
Vancouver BC V6B 5L5

After Hours

Health & Safety Emergency

604 273-7711
1 866 922-4357 (WCB-HELP)

