39 SHEET METAL

Contents

Accident Investigation

Purpose

Accidents that injure people or damage property on construction sites should be investigated. In some cases, investigation is required by law. Refer to sections 51-53 of the *Occupational Health and Safety Act*.

The purpose of accident investigation is to identify causes and prevent the accident from occurring again. The objective is not to blame anyone. The method is fact-finding. Investigation looks beyond the obvious immediate causes to determine what other, underlying causes may have contributed to the accident.

All concerned parties should be involved in accident investigation. Depending on the size and duration of the project, that may include the health and safety representative, the joint health and safety committee, the project superintendent, and foremen.

Investigators understand that accidents don't just happen. They are caused by some failure in planning, procedures, equipment, instruction, communication, or training. If the causes of failure aren't identified and corrected, they can lead to similar accidents in the future.

It is recommended that accident investigation results be discussed with all employees—in particular, the steps being taken to prevent a recurrence.

What to investigate

After an accident, employers need to

- record the facts
- determine the immediate and underlying causes
- identify possible accident or illness trends in order to counteract them
- substantiate a worker's claim in the case of personal injury
- take the steps necessary to prevent a recurrence.

When to investigate

Investigations should be conducted as soon after the accident as possible. There are several reasons for doing this.

- With the passage of time the accident scene will change, evidence may be removed, and immediate and underlying causes will become harder to pinpoint.
- Details are quickly forgotten.
- Witnesses may move on to other sites.
- Employers need to demonstrate promptly their commitment to determine causes and prevent accidents from recurring.

How to investigate

An investigation is usually conducted right at the accident scene. That helps to develop a clear picture and allow witnesses to show and point out things as well as describe and explain.

Witnesses should be interviewed separately. This helps to ensure that each witness recalls events without being influenced by hearing someone else's version. Investigators don't want everyone buying into a newspaper version. They look for facts, evidence, and a reconstruction of events that fits the different points that witnesses recall.

For instance, one witness may state, "There was a sharp snap," while another remembers "a ripping noise." The two reports are not necessarily contradictory. The sharp snap may indicate the sudden structural failure of an overloaded component while the ripping noise indicates a cable tearing apart following the failure.

Investigators try to establish

- conditions before, during, and after an accident
- activity being performed
- role of workers, supervisors, and witnesses
- involvement of machines or equipment
- factors such as weather, work surface, and ground conditions
- the sequence of events
- any deficiencies or breakdowns in the system that allowed the events to occur
- how the system can be corrected to prevent the accident in future.

Investigators establish these facts by

- keeping an open mind and never jumping to conclusions
- avoiding witch hunts, fault-finding, and blaming individuals
- contacting everyone involved
- sticking to the facts
- determining both immediate and underlying causes
- recording the details and recommendations so follow-up action can be taken
- ensuring that everyone understands that the purpose of the investigation is to gain the knowledge and understanding needed to prevent a recurrence.

The worker's role

Without the cooperation of workers, investigation will likely fail to disclose what caused the accident and how it can be prevented. Digging into the facts can be painful, but labour and management must work together to establish what happened, determine immediate and underlying causes, and take the action necessary to eliminate such accidents in the future. The full cooperation of all parties is therefore essential.

For more information, contact the Construction Safety Association of Ontario at 1-800-781-2726 and order the data sheet *Accident Investigation* (DS029), poster P103, and sticker S008.

Material Handling

Work areas

- Work areas should be laid out in advance to ensure safe and efficient operation.
- When stockpiling material for fabrication or installation ensure that a good solid base is provided for storage.
- If material is to be piled high, use sleepers to ensure a level and safe storage area.
- Keep work areas clear of clutter, debris, and scrap.
- Keep a box or barrel close by to dispose of scrap.

Preparing storage areas

- The area where the material is to be stored should be as level as possible, dry, well-drained and with good access.
- Avoid storing materials under powerlines, especially if hoisting equipment is being used to move it (O. Reg. 213/91, section 37).
- Sleepers should be used to keep the material off the ground and to allow slings

to pass freely under the load. Make sure there is adequate blocking available before material is delivered.

- Storage areas should be as close to the work area as possible, whether material will be handled by crane or carried by workers.
- The mechanical contractor and/or general contractor should be consulted before setting up site storage areas so that they are aware of potential weights to be stored in each area. Ensure that material stored on floors does not overload the structure, and that sufficient support is in place on newly poured slabs.
- To prevent accidents, all material should be stored at least 1.8 metres (6 feet) away from all open edges.
- Wherever practical, storage areas should be well laid-out with clear and direct access to work areas.
- Store so that material is free of mud, oil, grease, etc.
- In general, a clean work area is a safe work area. Store materials away from travelled walkways

Ventilate storage areas

Storage areas need to be well ventilated. The fumes given off by paint thinners, epoxies, acids, and other materials may be toxic or flammable.

Unloading and storage precautions

- Post DANGER signs and cordon off unloading areas as required.
- Serous accidents can occur if banding or tie-downs for bundles are released without containment and materials spill over.
- Be sure to communicate with the driver about unloading procedures.
- Land and block the load before unhooking and unslinging it. Lower loads onto adequate blocking to prevent damage to slings.
- Make sure identification tags are clearly visible in order to avoid extra handling.
- Space material so that it can be picked up without having to move other material. If material must be stacked in layers, put sleepers between each layer.
- Immediately after cutting, dispose of banding material, waste wire, or any other garbage in proper containers so that it doesn't become a hazard.
- Near openings, arrange material so that it cannot roll or slide in the direction of the opening.

Positioning the truck

- Position the truck as close to the crane unloading area as possible to avoid overreaching by the crane.
- The truck should be positioned on terrain as level as possible.
- Keep the truck and crane away from overhead powerlines.
- A truck backing up should be directed by a competent signaller using established signals (Figure 1).
- Truck wheels should be blocked or chocked during unloading.

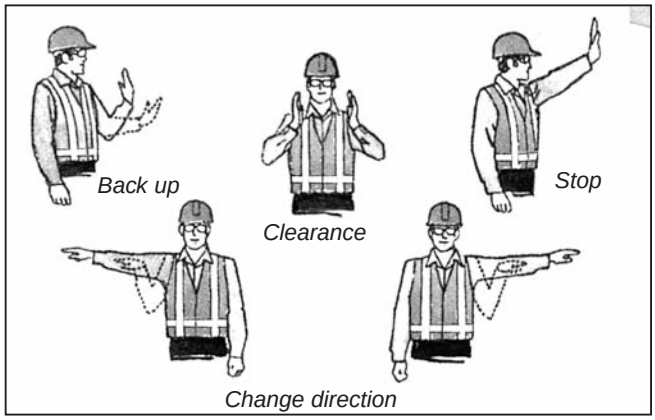


Figure 1. Hand Signals for Traffic Control

Mounting and dismounting from truck beds

- Many accidents have occurred as the result of workers getting on or off a flatbed truck. Situations will vary, but a commonsense approach should be followed.
- Before mounting the truck, scrape off your boot soles to avoid slips.
- Mount the truck platform in full view of the crane operator or signaller so that you will not be struck by the load or the crane hook.
- Climb up and down facing the truck, maintaining 3-point contract at all times (two hands and one foot, or two feet and one hand).
- If step and handrails are provided, use them. Stepping on tires or hubs affords poor footing.

Welding and Soldering

The following guidelines apply to welding, cutting, and brazing. For soldering, see the box entitled "Soldering" a few pages ahead.

Wear protective clothing

- Cotton or wool fibres if possible. Synthetic fibres are flammable.
- High-top safety shoes laced up, with pant leg covering top of shoe. A spark inside a shoe can cause a serious burn.
- Welding gloves.
- No cuffs on pants or shirt to catch sparks.
- Long hair tucked under a cap.
- Long-sleeve shirt to protect your skin from sparks and rays.
- Welding leathers if welding at high amperage for a long time.
- A welding cap and jacket if you are welding overhead.
- No jewelry.
- Use the right shade number for welding lenses. See Table 8.1. Both the welder and anyone assisting the welder must wear eye protection.

Table 8.1

Lens Shade Selection Guide for Welding

Shade numbers are given as a guide only and may be varied to suit individual needs.

Operation	Electrode Size mm (32nd in.)	Arc Current (Amperes)	Minimum Protective Shade	Suggested[1] Shade No. (Comfort)
Shielded Metal Arc Welding (SMAW)	less than 2.5 (3)	less than 60	7	–
	2.5-4 (3-5)	60-160	8	10
	4-6.4 (5-8)	>160-250	10	12
	more than 6.4 (8)	>250-550	11	14
Gas Metal Arc Welding and Flux Cored (GMAW)		less than 60	7	–
		60-160	10	11
		>160-250	10	12
		>250-500	10	14
Gas Tungsten Arc Welding (GTAW)		less than 50	8	10
		50-150	8	12
		>150-500	10	14
Air Carbon (light)		less than 500	10	12
Arc Cutting (heavy)		500-1000	11	14
Plasma Arc Welding (PAW)		less than 20	6	6 to 8
		20-100	8	10
		>100-400	10	12
		>400-800	11	14
Plasma Arc Cutting (PAC)				
Light[2]		less than 300	8	9
Medium		300-400	9	12
Heavy		>400-800	10	14
Torch Brazing (TB)		–	–	3 or 4
Torch Soldering (TS)		–	–	2
Carbon Arc Welding (CAW)		–	–	14
		Plate Thickness mm	in.	
Gas Welding (GW)				
Light		under 3.2	under 1/8	4 or 5
Medium		3.2 to 13	1/8 to 1/2	5 or 6
Heavy		over 13	over 1/2	6 to 8
Oxygen Cutting (OC)				
Light		under 25	under 1	3 or 4
Medium		25 to 150	1 to 6	4 or 5
Heavy		over 150	over 6	5 or 6

Figure 20.17

1. Shade numbers are given as a general rule. It is recommended to begin with a shade that is too dark to see the weld zone. Then one should go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the operation (spectrum).
2. These values apply where the actual arc is clearly seen. Experience has shown that light filters may be used when the arc is hidden by the workpiece.

Protect others

- Position yourself so that sparks go in the safest direction.
- Warn others in the area before striking an arc.
- Set up a screen to protect others from the welding flash.
- Check to see if sparks or molten particles could fall to a lower level or roll along the floor. Be especially careful about this when you are welding from a scaffold or ladder.

Avoid burns and fires

- Use a striker to ignite a torch flame. Using matches or a cigarette lighter can burn your fingers.
- Don't carry a butane lighter in your shirt or pants pocket. It may be ignited by sparks, splatter, or high heat.
- Clear the work area of flammable materials or debris.
- Never lay down a torch while the flame is burning.

Table 8.2
WELDING EXPOSURES

GAS	SOURCE	EFFECTS
Acetylene	From acetylene not completely used up in oxyacetylene welding.	In very high concentrations, usually in confined spaces, replaces oxygen in the air possibly causing suffocation
Argon/Helium	Used in gas-metal arc welding (GMAW) and gas tungsten arc welding (GTAW) to shield electrode from oxygen.	Same as above
Arsine	Possible contaminants of commercial acetylene	Anemia (from breaking up red blood cells), jaundice, pulmonary edema
Carbon Monoxide	Welding arc changes carbon dioxide in the air to carbon monoxide, GMAW can be a primary source. From incomplete burning during welding or soldering.	Headache, dizziness, concentration problems, anemia, heart disorders, and (in high enough concentrations) coma and death
Nitrogen Oxides (NO_2) & NO	Welding arc changes nitrogen in in air to nitrogen oxides. GMAW and plasma arc welding can be a primary source.	Respiratory irritant, pulmonary edema (delayed onset)
Ozone	Ultraviolet light caused by the welding arc changes oxygen in air to another form of oxygen, called ozone. GMAW and plasma arc welding can be primary sources.	Irritant to eyes, nose and throat, chest pains, wheezing. Can lead to pulmonary edema
Phosgene	Ultraviolet radiation from welding arc decomposes chlorinated solvents (degreasers) such as trichloroethylene and 1,1,1, trichloroethane	Respiratory irritant, chest pains, pulmonary edema, death (if concentrations are high enough)
Phosphine	Possible contaminant of commercial acetylene	Fatigue, tremors, coma, convulsions, pulmonary edema, and (with long-term exposure) anemia, problems with the gastrointestinal system

- If welding has to be done within 10 metres (30 feet) of flammable materials, provide a fire watch with fire extinguishers. The fire watch must stay at the location for half an hour after welding is completed.

Use oxygen safely

- Never use oxygen to blow dust from your clothes. It's a fire hazard.
- Never oil the oxygen regulator.
- Never use any grease or oil around oxygen. Oxygen mixed with the slightest trace of grease or oil can cause a violent explosion.

Avoid toxic fumes

- Make sure you have proper ventilation. Keep as much distance as possible between the welding plume and your face. Table 8.2 shows the effects of various gases used for or produced by welding.
- Check the MSDS for the welding rod and components to be used.
- Find out if the metal you are welding contains zinc, lead, cadmium, chromium, or nickel. These give off toxic fumes.
- Clean off any paint before welding, especially if it might be lead-based. Before removing lead, see the Ministry of Labour's guideline *Lead on Construction Projects,* available on www.labour.gov.on.ca.
- Remove any degreasers. When welded, chlorinated degreasers can produce phosgene gas, which is extremely toxic.

Other hazards

- Never weld or cut directly on a concrete floor. The combination of heat and moisture in the concrete can cause a small area of the concrete to spatter.
- Know the special hazards for each welding process. See *ITI Welding Book One* for more information.

Electric arc welding/carbon arc welding

- Any moisture—even sweat—around electric welding machines can cause a shock. Wear dry gloves and shoes with insulated soles. Dry off the workbench or floor if either is wet.
- Use the proper amp rating and duty cycle rating for the electric welding machine you are using. Overheating can damage insulation and lead to shock.
- Make sure the grounding cable is properly attached to the work or worktable.
- The leads that carry the welding current should not come in contact with chains, wire ropes, hoists, and elevators.
- Disconnect the power supply when moving the welding machine.
- Remove the electrode from its holder when the welding machine is not in use.
- Place electrode holders so that they do not come in contact with people or flammable materials.
- Never cool electrode holder by putting it in water.
- Make sure that the polarity switch, range switch, or both are not moved while the power source is being used. This can cause a fire and damage the machine.

Oxyfuel welding, cutting, and brazing

The compressed gas cylinders used for oxyfuel processes can be a hazard. They must be stored, handled, and used properly to avoid accidents.

Storing cylinders

Many gas cylinders, such as oxygen cylinders, are under high pressure. Damage to the valve can turn the cylinder into a rocket.

- Avoid any sudden shock to cylinders.
- Store all compressed gas cylinders upright

in a clean dry area away from oil, grease, flames, and flammable materials.

- Store cylinders upright and hold them in place with chains or cables. Use a cylinder cap to protect the valve, when applicable.
- Do not store oxygen cylinders within 20 feet of fuel gas cylinders such as acetylene, propane, or butane unless they are separated by a partition at least 5 feet high and having a fire resistance rating of at least 30 minutes (Figure 8.1).

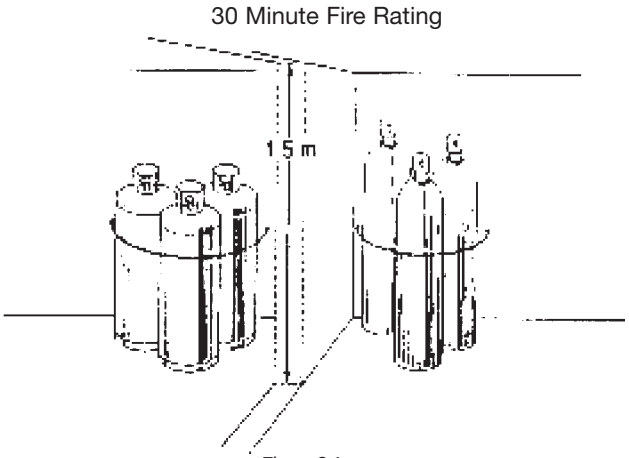


Figure 8.1

Handling cylinders

- Cylinders being transported should be secured in an upright position.
- Cylinder valves must be closed before the cylinder is moved.
- Never use cylinders as rollers or as supports, whether they are full or empty.
- Never remove cylinder caps with a pry bar.

Using cylinders

- Cylinders should be secured in an upright position while in use.
- Use positive action check valves at both the regulators and torch. These valves prevent the gas from flowing in reverse.
- Always use a regulator on a cylinder to reduce the pressure, unless the equipment is designed to withstand full cylinder pressure.
- Never force regulator fittings if they do not match the cylinder threads. Some regulator fittings (such as acetylene) have left-hand threads.
- Before connecting a regulator to a cylinder valve, open the valve briefly to blow away any dust.
- Never stand in front of the regulator when turning on the cylinder valve. In case of a malfunction, the explosion or fire will blow out the front of the regulator.
- Before removing a regulator, close the cylinder valve and release the gas from the regulator.
- Never allow any oil on an oxygen regulator. Oxygen under pressure can explode when it contacts oil.
- Use black iron pipe and fittings for acetylene. Never use copper pipe or fittings with acetylene. Copper and acetylene form acetylides which explode violently.
- Make sure that the fuel gas hose is red, the oxygen hose is green, and the inert gas hose is black (U.S. only). Acetylene hoses usually have left-hand threads.
- Open the valve on oxygen cylinders all the way to prevent leakage around the valve stem.
- Close all cylinder valves when you are away from work for any length of time.

Using acetylene

- Always keep acetylene hose pressure at less than 15 psi (pounds per square inch). Higher pressure creates a risk of fire.
- Leave a wrench on the acetylene cylinder valve for emergency turnoff.
- Open the acetylene cylinder valve only 1/4 turn so that if can be turned off quickly in case of an emergency.

- Breathing acetylene gas can cause dizziness, a light-headed feeling, or loss or consciousness. Acetylene is highly flammable. You can recognize acetylene by its garlic-like odour.

Soldering

- Wear eye protection because flux or solder can splatter.
- Ensure good ventilation while soldering or tinning a soldering iron. The sal ammoniac gives off irritating toxic fumes.
- Keep away from the soldering plume as much as possible because of the lead content in the plume.
- Rest a hot soldering iron in a holder. Do not put it on a workbench or on flammable material.
- When soldering outdoors, make sure the firepot is clear of any combustible material and is level and stable.
- Fill the propane tank for the firepot carefully and away from open flames. The tank is full when gas begins escaping from the relief valve.
- Use a damp cloth to clean a soldered joint. If water drops on the hot metal it could cause the flux to splatter.

Working with acid

- **Acid can blind you.** Acid fumes can cause breathing problems. Acid on your skin can burn. Use acid or other flux carefully.
- If acid gets in your eyes, wash immediately with cold running water. See a doctor immediately.
- If acid gets on your skin, wash it off with cool tap water right away, until the burning sensation subsides. See a doctor immediately.
- Ensure good ventilation while you work with acids.
- Acid on your clothing will rot the fabric and could contact your skin.
- Do not make cut acid near an open flame. The process gives off hydrogen gas that can explode.
- Do not fill a container for making cut acid more than half full. The hydrogen gas can cause the acid to bubble vigorously.
- Never add water to raw acid (hydrochloric acid) when making a solution. Add the acid to water, and add it slowly over a 10 or 15 minute period in a ceramic crock that can stand the heat produced.

Plastic welding

Sheet metal workers make ductwork out of plastic as well as sheet metal.

- PVC (polyvinyl chloride) ductwork is welded using a PVC filler rod heated with a hot-air gun. The filler rod is used like the filler for oxyacetylene welding.
- FRP (fibre-reinforced plastic) is chemically welded. A solvent dissolves the two surfaces so that they melt together. The process involves mixing a resin, promoter, and catalyst, which react together. The reaction produces heat over 360° F. That's enough to start a fire.
- Follow safety precautions for FRP welding:
  - Read the MSDS on any chemical or other material you use.
  - Check all chemical containers for leaks or cracks.
  - Wear proper protective equipment when working with any chemical.

  - Follow the manufacturer's guidelines for mixing chemicals and their catalysts. For safety, many components must be mixed in a specific sequence.
- Make sure you have good ventilation when opening and using chemicals.
- When transferring resins from 55-gallon drums, make certain the drums are electrically grounded to reduce sparking from static electricity.
- When you transfer resin to a smaller container, label the new container with the product name, chemical family, flammability, and use.
- Never experiment with the chemicals, catalysts, or their mixing ratios.
- Make certain that the proper class of fire extinguisher is available.
- A sign should identify the area where FRP materials are being prepared.
- Never dispose of a mixing container until the reaction has been completed and is no longer producing heat.

For more information, refer to the chapter on Welding and Cutting in this manual. Safe practices are also explained in the American Welding Society's ANSI Z49 publication *Safety in Welding and Cutting* and in the Canadian Standards Association standard *Safety in Welding, Cutting and Allied Processes* (CAN/CSA-W117.2).

Ventilation

Whether you're welding, cutting, fabricating, or installing, you need clean air on the job.

Air polluted by toxic gases and particles can make breathing hazardous. If you work indoors, you could be trapped in bad air if there is not enough ventilation.

Air may be a hazard even though there are no danger signs. A toxic gas may be odourless (as carbon monoxide is).

Some hazards have short-term effects that you feel immediately such as burning eyes, dizziness, coughing, and headaches. Other air hazards have long-term effects that you might not feel for 20 years or more, such as cancer or asbestosis.

The first step is to control the source of air contamination. Changing a process or using a safer material might do this.

If the air pollution cannot be avoided, some other step is needed to make breathing safe. One solution is better ventilation. Another is to wear a respirator.

Ventilation takes care of most jobsite air hazards. It removes contaminated air and replaces it with outside air. Ventilation may use natural air movement or forced air.

Local exhaust ventilation

Local exhaust ventilation means removing air at the source of the contaminant. Figure 9.1 shows three different methods. A filter is added if the air contains solid particles such as dust, paints, or oils. Local exhaust is usually more effective than general ventilation, but it is not 100% effective.

- The process or equipment should be enclosed as much as possible.
- The airflow rate has to be high enough to pull the contaminant into the airstream.
- Intake air must be equal to the air being exhausted.
- Intake air must be free of contamination. Intake vents should not be close to exhaust vents.

- Exhaust air must be filtered or otherwise treated so that clean air is exhausted to the atmosphere. Filters should be cleaned or replaced regularly.

Hazardous fumes

- Zinc from welding galvanized sheets can cause metal fume fever. Symptoms are similar to flu. Metal fumes can cause nausea, fever, and shaking chills and should be avoided.
- Welding stainless steel creates chromium fumes, which can be hazardous.
- Hydrochloric acid used as a soldering flux releases chlorine gas when applied to metal. Chlorine is hazardous.
- Lead, found in solder and certain alloys, causes serious health problems. It is stored in the body for a long time.
- Solvents used for many operations can also be hazardous.

Ventilate storage areas

Storage areas need to be well ventilated. The fumes given off by paint thinners, epoxies, acids, and other materials may be toxic or flammable.

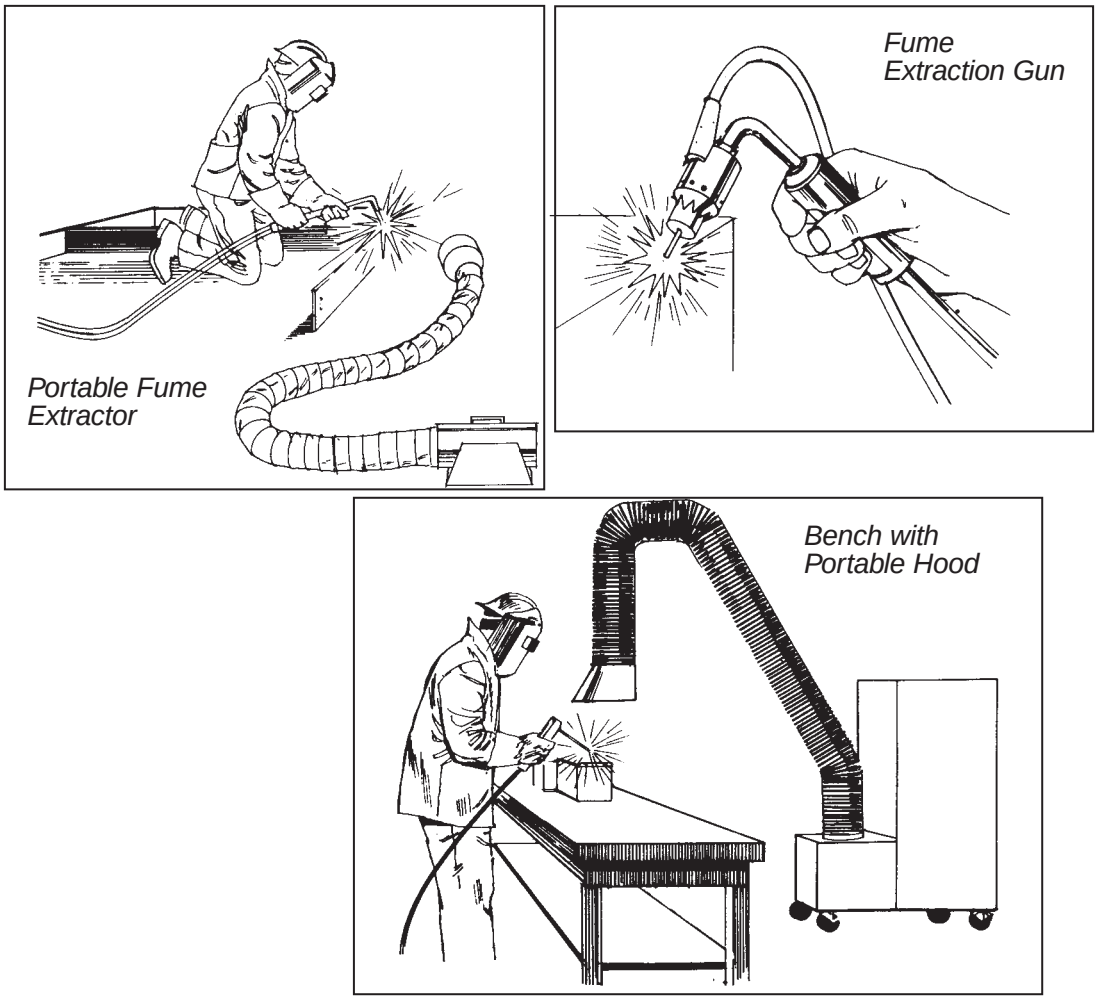


Figure 9.1: Local exhaust ventilation for welding

Fire Safety

Important!

- If your clothing catches fire, STOP, DROP, and ROLL.
- If you suspect a fire, sound an alarm.
- Applied as soon as possible, smothering can usually put out a small fire.
- Know the location of fire extinguishers wherever you work.

The construction regulation (O. Reg. 213/91) requires that workers be trained to use fire extinguishers.

Information in this chapter has been taken from the *Occupational Health and Safety Act and Regulations for Construction Projects*. The intention is to provide a general summary of the duties required of various personnel.

Fire basics

- The words *flammable* and *inflammable* both mean the same thing—burning easily.

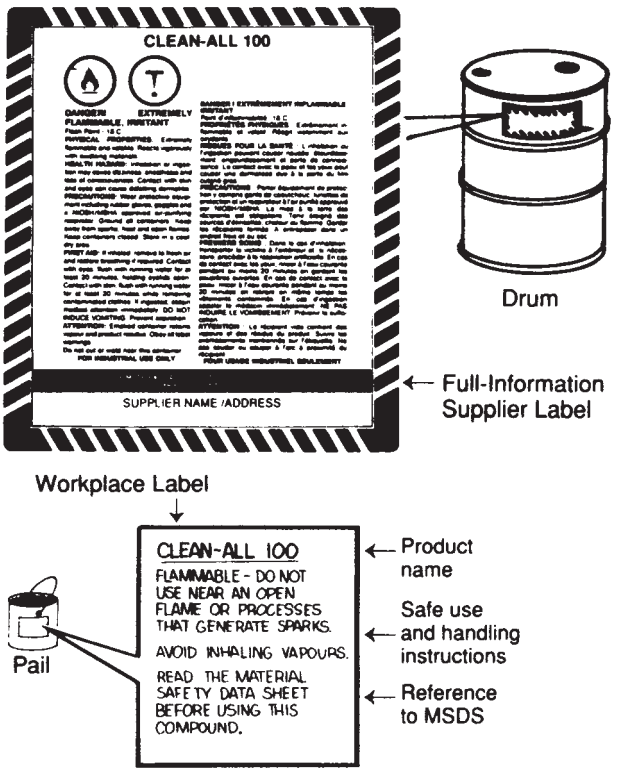


Figure 11. 1 Hazardous materials should be identified

- Some materials may have labels that indicate a fire hazard Figure 11.1
- A fire needs three ingredients—fuel, oxygen, and heat.
- Most fires at a sheet metal shop or jobsite are due to

  –flammable vapours from solvents, adhesives, and fuel gas

  –sparks and hot metal form grinding, cutting, welding, brazing, and soldering

  –electrical overloads.
- These common causes of fire can be eliminated by good housekeeping, proper maintenance, and safe work practices.
- Know the four basic types of fire (Table 11.1).

Table 11.1 – Classes of Fire

CLASS	TYPE OF FIRE	MATERIALS
A	Common materials	Wood, paper, fabric, grass, grain, coal, rubbish
B	Flammable liquids and vapours	Gasoline, oil, paint, varnish, solvents, grease, wax, fat, oil
C	Electrical	Motors, switch boxes, transformers, generators, wiring
D	Combustible metals	Magnesium, titanium, zirconium, sodium, lithium, potassium

Fire classification

Fires are broken down into four different classes (Table 11.1). You should be familiar with each class in order to know which fire extinguisher to use and in order to take proper precautions.

Class A – Common materials such as wood, paper, fabric, grass, grain, coal, and rubbish.

- Keep storage and work areas free of debris.
- Do not leave portable heaters unattended.
- Do not block the sprinkler system with stacked goods.
- Use care when welding and cutting.

Class B – Flammable liquids and vapours such as gasoline, oil, paint, varnish, solvent, grease, wax, fat, and oil.

- Store flammable liquids in tightly closed approved containers.
- Keep these materials away from sparks.
- Spray cans, paint cans, and other containers for flammable liquids must be disposed of as hazardous materials.
- Follow all safety procedures for gas cylinders.
- Clean up flammable liquid spills promptly.
- Put rags used to clean up spills (and other oily rags) in airtight containers and dispose of them daily.
- Do not refuel gasoline-powered equipment in confined spaces or while the equipment is hot.
- Use non-flammable solvents whenever possible.
- Do not weld near flammable liquids.
- Do not turn on electric switches or operate electrical equipment if there are vapours or unidentifiable odours. An electric spark can cause an explosion.
- Check the MSDS to find the flash point — the temperature at which vapours will catch fire.

Class C – Electrical equipment such as motors, transformers, switch boxes generators, and wiring.

- Do not overload fuses, circuits, motors, or outlets.
- Do not install a fuse rated higher than that specified for the circuit.
- Clean and lubricate motors regularly.
- Inspect electrical equipment for old wiring, damaged insulation, and loose connections.
- Install a wire guard around utility lights.
- Investigate strange smells around electrical equipment or appliances.

Class D – Combustible metals such as magnesium, titanium, zirconium, sodium, lithium, and potassium (these are rarely a problem for sheet metal workers)

Figure 11.2

Class "A" Extinguishers

For fires in ordinary combustible materials such as wood, paper, and textiles where a quenching, cooling effect is required.

Class "B" Extinguishers

For flammable liquid and gas fires, such as oil, gasoline, paint and grease where oxygen exclusion or flame interruption is essential.

Class "C" Extinguishers

For fires involving electrical wiring and equipment where the non-conductivity of the extinguishing agent is crucial.

This type of extinguisher should be present wherever functional testing and system energizing take place.

Class "D" Extinguishers

For fires in combustible metals such as sodium, magnesium, and potassium.

How to Use the Extinguisher

Aim the extinguisher at the base of the fire to extinguish the flames at their source.

- Use MSDSs to determine the hazards and storage requirements of combustible metals.
- Place metal shavings in proper containers.

Fire extinguishers

Check the fire extinguisher label to see which class(es) of fires it can be used for (Figure 11.2). Some fire extinguishers can be used for more than one class of fire. The label also covers operating instructions and recharge procedures, first aid information, and general guidelines.

- Let your employer know if an extinguisher is damaged.
- One component of fire-extinguisher training is the PASS procedure (Figure 11.3):
  - Pull the pin and break the seal.
  - Aim the nozzle at the base of the flame.
  - Squeeze the lever while holding the extinguisher upright.
  - Sweep the nozzle from side to side.
- Do not try to fight a fire if
  - the fire is spreading rapidly
  - the fire is blocking the path of escape
  - adequate fire-fighting equipment is not available.

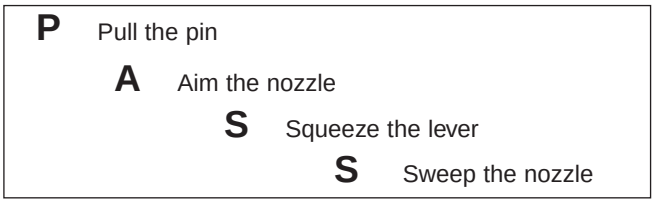


Figure 11.3 Learn the PASS procedure for using a fire extinguisher.

Evacuation procedures

To evacuate a burning building safely:

- Sound the alarm.
- Turn off electrical equipment (if safe to do so).
- Close windows that do not lead to fire escape routes.
- Close the door after everyone has left a room. Do not lock the door.
- Notify anyone who may not have heard the alarm.
- Leave the area quickly. Do not panic.
- Leave by an appropriate route. More fire deaths are caused by smoke and gases than by flames. Follow these rules:
  - Feel a door to see if it is hot before you open it.
  - Stay low to avoid smoke and toxic gases; crawl if necessary.
  - Cover your nose and mouth with a damp cloth.
  - Use stairs instead of elevators.
  - Report to an assigned, pre-determined location outside the building.
- If you have no safe escape route:
  - Seal cracks around doors, windows, and vents with wet towels.
  - If a telephone is available, tell the fire department your exact location.
  - Wait by the door or a window for fire department to arrive.

Shop Safety

Sheet metal shops do not fall under the Construction Regulation (O. Reg. 213/91). They are governed by the regulation for Industrial Establishments (Reg. 851). For responsibilities of workplace parties and procedures to follow, refer to the *Occupational Health and Safety Act and Regulations for Industrial Establishments.*

SAFETY BASICS

Accidents are waiting to happen in a sheet metal shop. The sharp edges of sheet metal can scratch you, gouge you, and even amputate fingers and hands. Equipment can easily crush your hands or blind you if you don't use it carefully.

By following some simple safety rules, you can keep yourself and your fellow workers safe from most hazards.

- Watch your step! The shop has many things you can trip on.
- Pick up scrap or other materials on the floor before you or someone else trips over it.
- Wear goggles or safety glasses as needed, especially around welding, grinding, or polishing operations.
- Watch out for heavy moving carts. Don't let yourself get caught between a cart and a solid obstacle, such as a wall or piece of machinery.
- Don't try to carry more than you can safely handle. Get help. You can avoid injury to yourself and to others as well. A large piece of sheet metal that you drop could injure someone.
- Don't try to catch falling materials.
- Don't distract someone who is operating machinery. Don't let yourself be distracted.
- Don't wear loose clothes or jewelry on the job. These items can easily get caught in power equipment. Long hair should be tied up or tucked under a cap.

SPECIFIC GUIDELINES

Access

Keep permanent aisles and passageways clean, clear, and in good repair. Aisles and passageways should be marked by painted lines, curbings, or other methods to distinguish them from work areas.

Permanent roadways, walkways, and material storage areas in yards should be maintained free of dangerous depressions, obstructions, and debris.

Work areas

Permanent floors and platforms should be free of dangerous projections or obstructions and should be kept in good repair and reasonably free from oil, grease, or water. On slippery surfaces, workers should be protected against slipping by mats, grates, cleats, or equivalent measures. Floors and platforms should be constructed and maintained to support the loads to which they are subjected.

Storage

The maximum weight of materials stored on temporary floors or load-carrying platforms should not exceed their safe carrying capacity.

Wherever stored, material should be piled, stacked, or racked in a manner to prevent it from tipping, falling, collapsing, rolling, or spreading. Racks, bins, planks, sleepers, bars, strips, blocks, and sheets should be used where necessary to make the piles stable.

Sanitation

Safety devices, including protective clothing, should not be interchanged among employees

unless the equipment is properly cleaned. Exception: safety devices worn over shoes or outer clothing, no part of which contacts the skin of the wearer, such as metal foot guards.

Toilets

Every place of employment should be provided with a sufficient number of conveniently located water closets for the use of employees. Toilets should be clean and provided with an adequate supply of toilet paper.

Compressed air or gases

Compressed air or other gases should not be used to blow dirt, chips, or dust from clothing or protective equipment while it is being worn.

Compressed air or gases should not be used to empty containers of liquids where the pressure exceeds the safe working pressure of the container.

The use of compressed air for cleaning machines and tools should be controlled—or proper safety devices or safeguards should be applied—to reduce or eliminate hazards to the eyes.

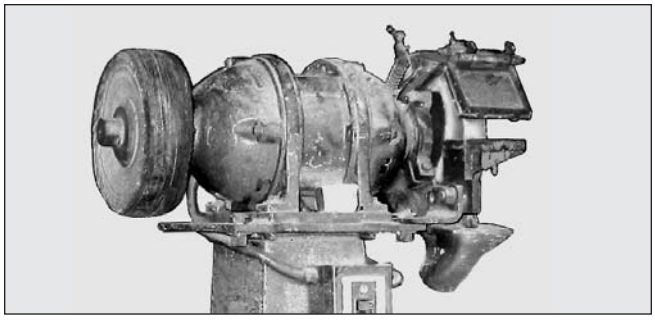
Flying particles or substances

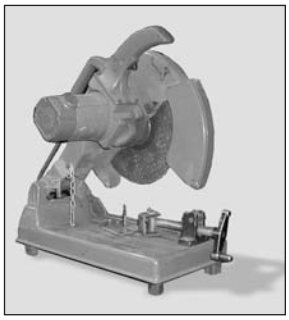
Wherever the danger of injury from flying particles or substances cannot be eliminated by the use of personal safety devices and safeguards, then adequate shields, screens, chip guards, or enclosures should be provided. These should be designed and constructed to deflect or confine the flying particles or substances and thereby prevent injury to employees.

MACHINES AND EQUIPMENT — GENERAL

Management must ensure

- that all supporting structures, foundations, and fastenings for machines and equipment are designed, constructed, and maintained to support expected loads safely and without dangerous vibration
- that equipment is of adequate design for expected use





- that equipment is not operated at hazardous speeds, loads, or stresses
- that defective parts are repaired or replaced
- that a record of repairs, replacements, and other maintenance is kept for each machine and piece of equipment
- that all machine operators and assistants are properly trained in safe use of the equipment and conduct regular maintenance checks
- that fire extinguishers are provided as required
- that personal protective equipment (PPE) to be used with machines and equipment is available
- that periodic safety talks or meetings are held for employees.

Operators must

- never eliminate or bypass any safety devices installed on the machine
- wear all PPE required by law and by the employer
- keep work areas clean, safe, and uncluttered
- report any defect or malfunction immediately

- never operate equipment or machinery in excess of capacity
- be certain that equipment is properly grounded where required
- avoid becoming careless, overconfident, or caught up in the rhythm of the operation at the expense of health and safety
- never remove warning plates or operator's instructions from machines and equipment
- never store anything in machines or equipment that may fall out into the work area
- never stand or sit on anything while feeding machines that could cause you to fall, slip, or stumble into bending area
- never tie down or otherwise disarm actuating devices to provide continuous operation.

MACHINES AND EQUIPMENT — LOCATION

Permanently installed machines should be arranged or guarded so that

- they and their operators cannot be struck by moving equipment and material
- product, waste stock, or material being worked or processed will not endanger employees.

Skirt guards or similar devices should be used wherever there are shear hazards between pit edges and the machinery or equipment installed and operating there.

CLEANING, REPAIRING AND ADJUSTING PRIME MOVERS

1) Use extended swabs, brushes, scrapers, and other tools where machinery cannot be locked or blocked against movement during cleaning, adjusting, and other operations.
2) Every machine driven by a prime mover and equipped with lockable controls, or readily adaptable to lockable controls, should be locked in the OFF position during repair work.
3) Machines or prime movers not equipped with lockable controls, or readily adaptable to lockable controls, should be disconnected from the power source to prevent inadvertent start-up and operation.
4) In all cases, warning signs or tags with adequate wording should be placed on the controls of machines and prime movers during repair work.
5) The employer must provide enough signs, padlocks, and similar devices for use during emergency repairs. Signs must be equipped with a means of attachment that can be secured to the control.

MACHINE GUARDS

Guards are required on any shop equipment that could cause injury or accident.

- Never remove a guard unless it is necessary to adjust the machine.
- If you must remove a guard, never do so while the machine is running.
- Never start a machine if the guards are not in place.
- Protect the treadle on foot-controlled presses. Use a guard designed to prevent accidental tripping or a specially designed treadle.
- Make sure that openings in treadle guards aren't more than twice the width of the foot. The only exception is for the long bar that extends across the machine.

SHOP EQUIPMENT — SPECIFIC TYPES

Press Brakes

Power press brake – This is a power-driven machine fitted with rams or dies for the purpose of blanking, trimming, drawing, punching, stamping, forming, or assembling cold materials.

- Post a sign on the front of every power brake. "Warning: Never place your hands or any part of your body under the ram within the point of operation."
- Many operations performed on power brakes in sheet metal shops allow the use of point-of-operation guards and/or two-handed actuators. Use them whenever possible.
- Where no point-of-operation guard (two-handed actuating devices, presence-sensing devices, etc.) can be used, it is still your responsibility to see that safe operating procedures are followed.
- Presence-sensing guards are available for power brake operations.
- Where the nature of the work prevents the application of guards, use hand tools appropriate to the job.

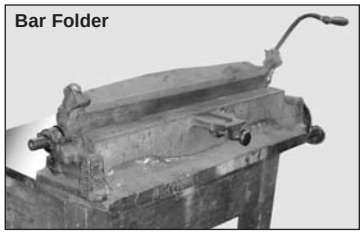

Power Press Brake

- Keep a safe distance from the point of power brake operation.
- Never place fingers, hands, arms, elbows, head, or feet in the dangerous bending area or near any moving part.
- Guards and area obstructions should be placed over various power brake components such a flywheels, gears, sprockets and chain belts, or other moving parts.
- Always use safety tools, fixtures, and supporting devices for loading and unloading.

Hand brake – This is a machine actuated by hand power only. It is used for forming materials.

- Take precautions to prevent injury to hands and fingers.
- When more than one person is working on this equipment, coordinate the operation. Make sure your partner's hands are clear before clamping the handles.


Hand Brake


Bar Folder

- Never put your hand between the upper leaf and the bending leaf.
- Place safety barriers to limit access around counterbalance weights.

Bar folder – This machine is actuated by hand power only and used for forming materials. Take precautions to prevent injury to hands and fingers.

Shears

Power shear – This is a power-driven machine used to shear plate and sheet metal.


Power Shear

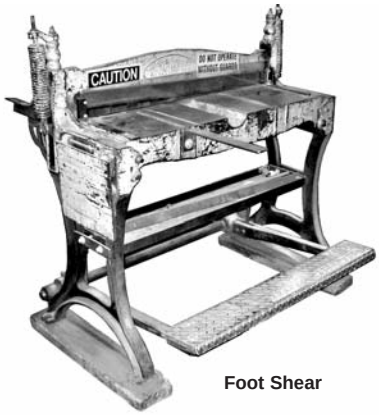
- Post a sign on every

power shear. "Warning: Do not extend fingers or hands beyond guard or barrier."

- Power shears must be equipped with guards to keep hands and fingers out of the point of operation and the material hold-down.
- Place personnel barriers with warning signs at the rear of the machine to prevent anyone from entering this area during operation.
- Never place fingers, hands, arms, elbows, head, or feet in the dangerous cutting area or near any moving part.

Foot shear – This is a manually powered machine.

- Never try to hold narrow pieces of material at the front of the shear.
- Do not hold short pieces of metal in back of the blade.
- Keep your foot out from under the treadle so you don't step on your own toes.

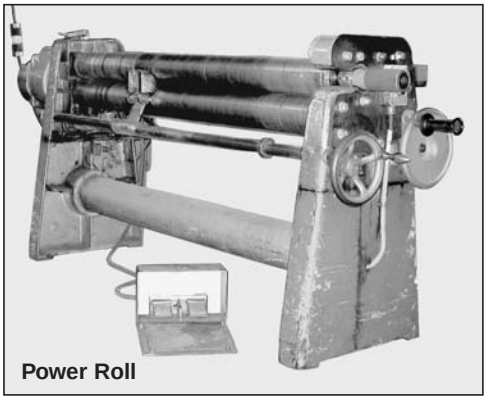


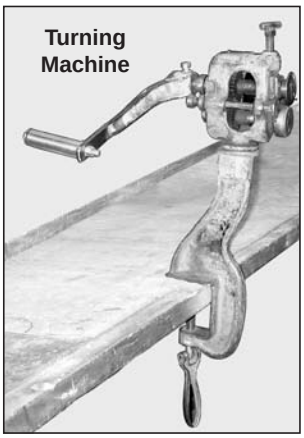
Foot Shear

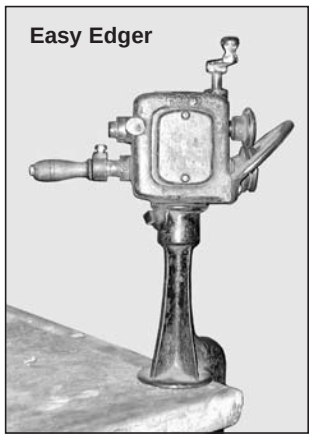
- No one should stand behind the shear unless necessary. A worker behind the shear should
  - know when the shear is coming down
  - stand clear of the shear mechanism and gauge bar
  - watch out for the shear metal as it falls.


Beverly Shear

Beverly shear – This is hand-operated equipment used to cut or notch light gauge metal. Take precautions to prevent injury to hands and fingers.


Power Roll


Turning Machine

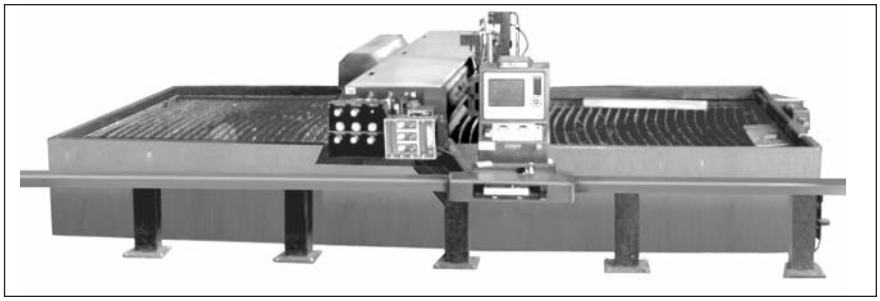

Easy Edger

Forming Rolls

Power rolls – These are power-driven machines used to form round shapes of sheet metal.

- The feed side of the rolls should be protected with a fixed or self-adjusting barrier to prevent the operator's fingers from getting caught between the rolls or between the guard and the rolls. The control device should be of the constant-contact type, located to keep the operator out of danger.
- The prime mover should be equipped with an effective brake. Across the front of the rolls at knee height, a control bar, lever, or other device should be installed. When activated, this device should stop the motor and apply the brake.
- Never wear gloves or loose clothing around a power roll.

Hand rolls – These are hand-operated machines used to form and shape sheet metal. Operators should not wear gloves or loose clothing and should take precautions to avoid injury to fingers and hands.



Cutting Equipment

Plasma cutter

- Ensure the area is properly exhausted.
- Take care when lifting to load the table.
- Ensure that all scrap pieces are removed before starting a new operation.
- Shield the cutting head.
- Wear gloves when loading and removing material.

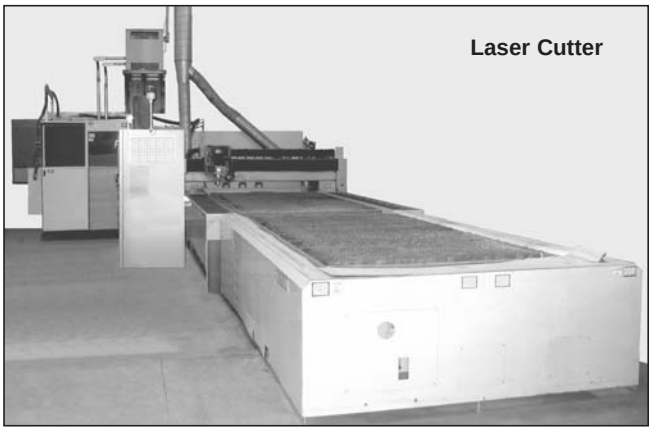
Laser cutter

- Ensure the area is properly exhausted.
- Take care when lifting to load the table.
- Ensure that all scrap pieces are removed before starting a new operation.
- Shield the cutting head.
- Wear gloves when loading and removing material.

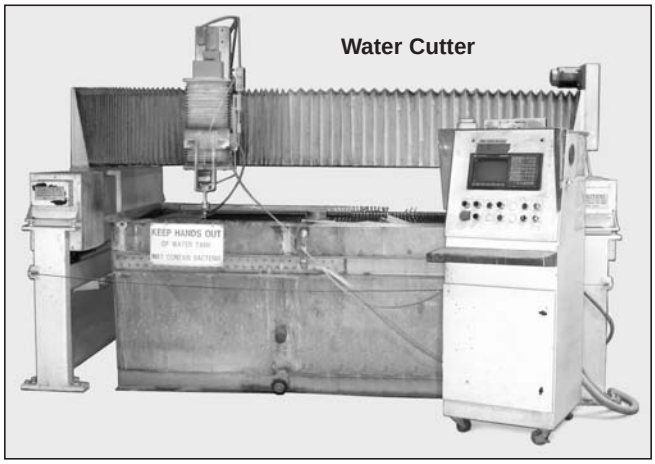
Water cutter

- Ensure the area is properly exhausted.
- Take care when lifting to load the table.
- Ensure that all scrap pieces are removed before starting a new operation.
- Wear gloves when loading and removing material.
- Keep hands well clear of the water jet.
- Do not put hands in waste water.

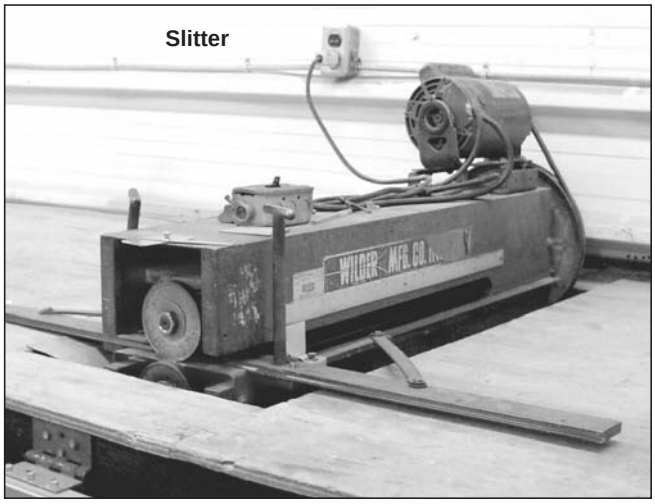
Slitter – This is a power-driven machine used to cut strips of sheet metal. When you run metal through the slitter, don't let the metal slide through your hands.



Laser Cutter



Water Cutter

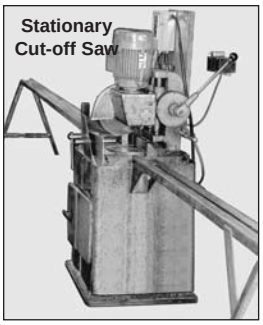


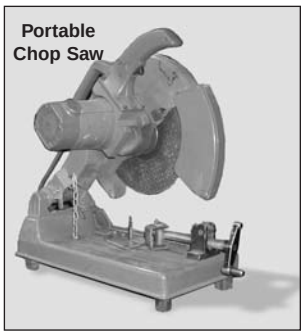
Slitter

Saws

Cut-off saw – This device is a powered circular saw that normally uses a friction cut-off wheel. It comes in both stationary and portable models.

Band saw – This is a power-operated saw that uses a continuous circular band blade for cutting.

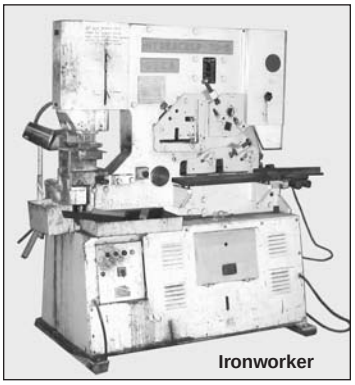




Power hack saw – This device is powered, base-mounted, and usually self-oiling to ease cutting.

- Before using, make sure that
  - all guards are in place
  - blade travels true
  - guard comes to within 1/4" of metal being cut
  - tension control device is properly set.
- Never load stock while the blade is operating.
- Always support long and heavy stock in front of and behind the saw.
- Never attempt to dislodge or move stock while the blade is operating.
- Always wear eye protection.
- Always hold the workpiece firmly against the table.
- Do not remove jammed cut-off pieces until the blade has stopped.
- Never wear loose clothing and gloves while operating the saw.

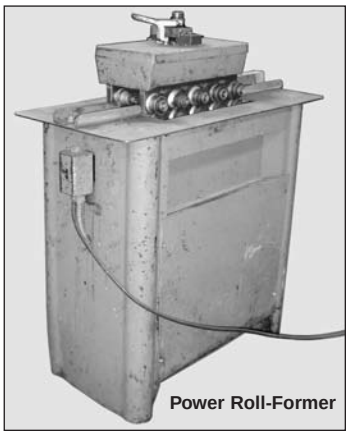
Ironworker – This powered machine is used to cut, punch, and form steel angle, channel, and bar stock of all shapes.



- Take care to prevent injury to hands and fingers.
- Always wear safety goggles.
- Make sure that punch and die are aligned.

Other Equipment

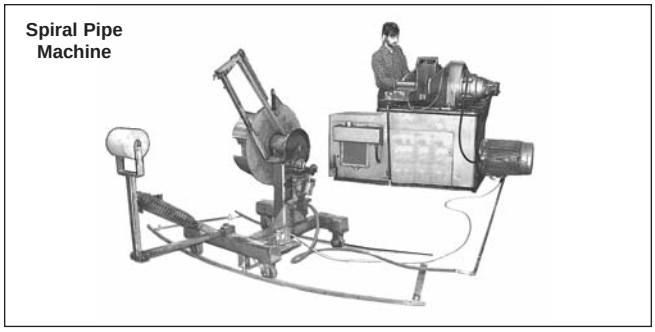
Power roll-former – A power rollformer is used to form locks and seams on sheet metal.

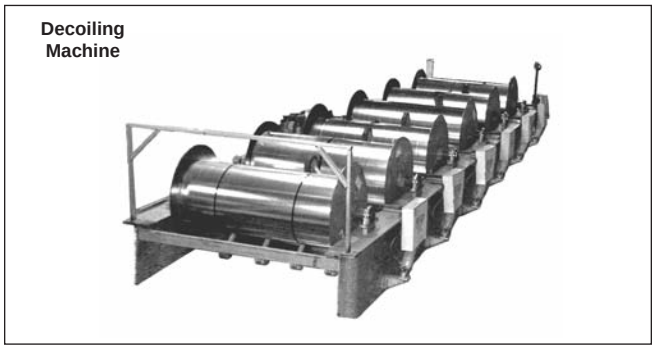


- When you run metal through the former, don't let the metal slide through your hands. Sharp edges and fishhooks can cause deep punctures.

Spiral pipe machine – This powered machine is used to form spiral duct.

- Take precautions against flying debris.
- Wear safety goggles and leather gloves.


Spiral Pipe Machine


Decoiling Machine

Decoiling machine – This powered machine uncoils steel coils to produce sheets.

- Never stand under or in front of a coil while it is being moved.
- Do not stand in front or in back of a coil while aligning the coil roller onto the take-off holder.
- Hold the coil band firmly so that it cannot snap out and cut you.
- Wear leather gloves.

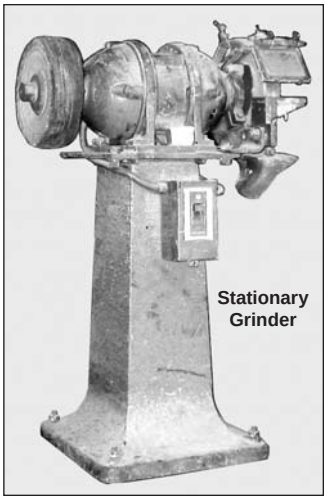
Drill press – a power drill is bolted to a bench and the chuck is lowered by an operating wheel or lever.

- Centre-punch the work to keep the bit in place when starting to drill.
- Remove chuck key before drilling.
- Always where safety goggles.
- Never wear gloves when drilling.
- Securely clamp short pieces of material before drilling.


Drill Press

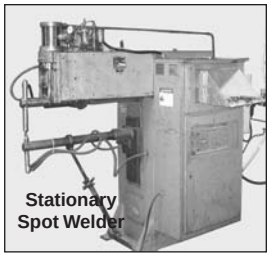
Stationary grinders – A powered machine used to grind or de-burr metal components as required.

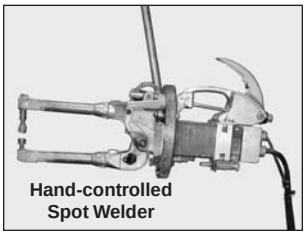
- Secure to prevent dangerous vibration. Mount on substantial floors, benches, foundations, or other solid structures.
- Equip grinder with adjustable work rest of rigid construction. Adjust work close to wheel with maximum clearance of 1/8".


Stationary Grinder

- Always wear hearing protection, gloves, and goggles.
- Provide abrasive wheels with protective hoods designed and constructed to protect employees against flying fragments from a burst wheel.
- Never use defective wheels.
- Only use wheels clearly marked with speed limitations.
- Dress wheels on a regular basis.

Spot welders – These devices use electrical resistance to generate the heat necessary to spot-weld material. Always wear gloves, face shield, and clothing that will protect you from sparks. Make every effort to screen operations from other workers.


Stationary Spot Welder


Hand-controlled Spot Welder

Pneumatic riveter – This air-driven tool is used to draw rivets.

- Take care to prevent injury to hands and fingers.
- Always wear safety goggles.
- Ensure that rivet is properly set.

Paint shop – This is a separate building or designated area of an occupied building used specifically for painting.

- Ensure that paint shop is well ventilated.
- Wear adequate and proper clothing, respirators, and eye protection.
- Secure and check all couplings.
- Ensure that paint operations are a safe distance away from sparks or other sources of ignition.

Power forklifts – The operator must be certified.

Manual forklifts – With hand-operated pallet lifters, make sure the load is centred and the floor free of debris.

Overhead Cranes

Overhead cranes are generally used for indoor hoisting. They are often installed for specific repetitive tasks. The capacity of these cranes is wide ranging. Contractors may use them for specialized hoisting operations such as removing or installing major plant equipment.

Safe operation of overhead cranes requires operators to have the knowledge and competence to employ safe rigging practices. The rigger must rig the load to ensure its stability when lifted.

Power drive runway or monorail cranes are used to move heavy materials and to hold materials during the fabrication process. All such equipment must be maintained in good working order and inspected annually to ensure that all components operate properly and show no signs of undue wear or damage.

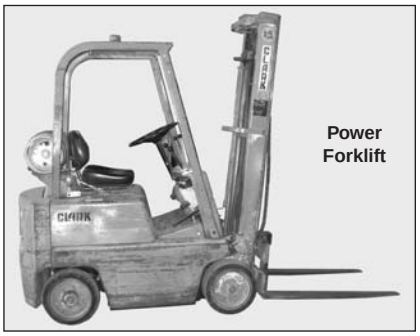
All overhead cranes must be inspected annually by a competent person.

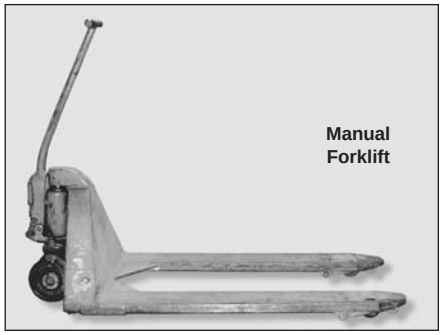
> Ensure that the load is free to move. If it becomes stuck and the crane begins or continues to lift, the crane may reach its full capacity quickly. There may be little or no warning of this condition and rigging components may fail.

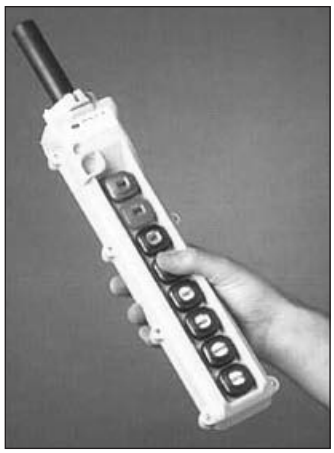

Pneumatic Riveter


Paint Shop


Paint Shop


Power Forklift


Manual Forklift



- The operator must be a competent person.
- Ensure that the sound alarm works properly.
- Before use, ensure that the crane is suitable for the planned hoisting task(s). Confirm it has appropriate travel, lift, and capacity.
- Inspect the crane before use. Check for damage, wear, and proper operation of all functions.
- Confirm the load weight. Check the capacity of all equipment including hardware, rope, and slings. Do not exceed these capacities.
- Select the right sling for each lift. Before use, inspect slings and other rigging hardware for wear, stretch, or other damage. Do not use damaged or defective slings. Use softeners around sharp corners. Do not splice broken slings.
- When communicating with a crane operator, use clear agreed-upon signals. Except for the stop signal, the crane operator should follow instructions only from a designated signaller. Where a wired or remote controller is used, the operator should become familiar with all of its functions before lifting the load.
- Warn all people in the lift area before starting the lift. Ensure that the path of the load is clear of persons and obstructions. Do not lift a load over anyone.
- Centre the crane hoist over the load before hoisting to prevent the load from swinging.
- Slide the sling fully onto the hoisting hook and ensure the safety catch is fully closed. Do not load the hook tip or hammer a sling into place.
- Secure unused sling legs. Do not drag slings or leave loose material on a load being hoisted.
- Keep hands and fingers from being trapped or pinched between the sling and the load when the slack is taken out of the sling. Step away before the lift is made.
- Move the load and controls smoothly. Minimize load swing.
- Walk ahead of the load during travel and warn people to keep clear. Use a tag line to prevent rotation or uncontrollable motion. Raise the load only as high as necessary to clear objects. Do not ride on the hook or the load.
- Set the load down on blocking, never directly on a sling. Do not pull or push the load out from under the hoist.
- Do not leave the load or the crane unattended while a load is suspended.
- Where crane operation by other personnel must be restricted, employ tag and lockout procedures.
- Store slings off the floor in a clean dry location on hooks or racks. Do not leave slings, accessories or blocking lying on the floor.

HAND AND POWER TOOLS

Chainsaws

Each year in Ontario, construction workers are injured while using chainsaws. Generally the injuries result from two types of accidents:

1) the operator makes accidental contact with the revolving chain

2) the operator is struck by the object being cut, usually a tree or heavy limb.

Many of these injuries are serious.

While the chainsaw is relatively easy to operate, it can be lethal. As with all high-speed cutting tools, it demands the full attention of even the trained and experienced operator.

Requirements

Chainsaws can be powered by electric motors (Figure 155) or gasoline engines (Figure 156).

Both saws are designed to provide fast cutting action with a minimum of binding in the cut, even though wood may be sap-filled or wet. Both afford about the same performance in terms of horsepower and they are equipped with similar controls and safety devices.

Regulations require that chainsaws used in construction must be equipped with a chain brake. Make sure that the saw is equipped with a chain brake mechanism, and not simply a hand guard, which is similar in appearance.

Regulations require that chainsaws used in construction must be equipped with "anti-kickback" chains. Called safety chains (Figure 157) by the manufacturers, these chains incorporate design features intended to minimize kickback while maintaining cutting performance.

Protective clothing and equipment

- Eye protection in the form of plastic goggles is recommended. A faceshield attached to the hard hat will not provide the total eye protection of close-fitting goggles.
- Leather gloves offer a good grip on the saw, protect the hands, and absorb some vibration. Gloves with ballistic nylon reinforcement on the back of the hand are recommended.
- Since most chainsaws develop a high decibel rating (between 95 and 115 dBA depending on age and condition), adequate hearing protection must be worn, especially during prolonged exposure.
- Trousers or chaps with sewn-in ballistic nylon pads provide excellent protection, particularly for the worker who regularly uses a chainsaw.

Kickback

Kickback describes the violent motion of the saw that can result when a rotating chain is unexpectedly interrupted. The cutting chain's forward movement is halted and energy is

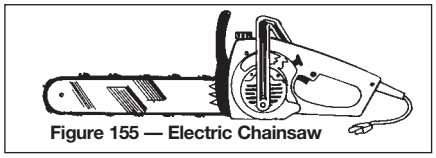


Figure 155 — Electric Chainsaw

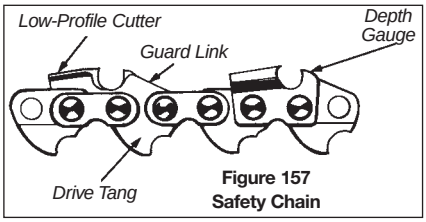


Figure 157
Safety Chain

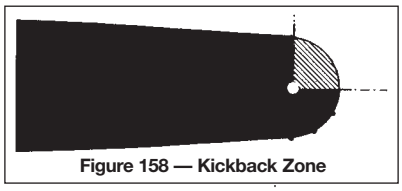


Figure 158 — Kickback Zone

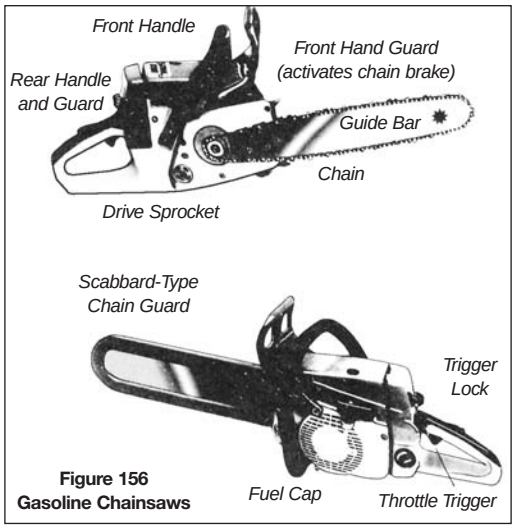


Figure 156
Gasoline Chainsaws

transferred to the saw, throwing it back from the cut toward the operator.

The most common and probably most violent kickback occurs when contact is made in the "kickback zone" (Figure 158).

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

To minimize the risk of kickback

- use a low-profile safety chain
- run the saw at high rpm when cutting
- sharpen the chain to correct specifications
- set depth gauges to manufacturers' settings
- maintain correct chain tension
- hold the saw securely with both hands
- don't operate the saw when you are tired
- know where the bar tip is at all times
- don't allow the cut to close on the saw
- make sure the chain brake is functioning.

Starting

When starting, hold the saw firmly on the ground or other level support with the chain pointing away from your body and nearby

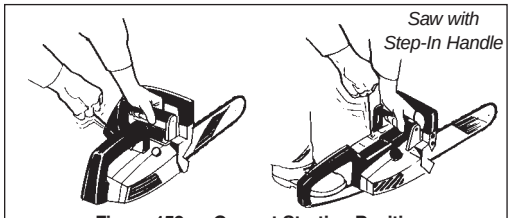


Figure 159 — Correct Starting Position

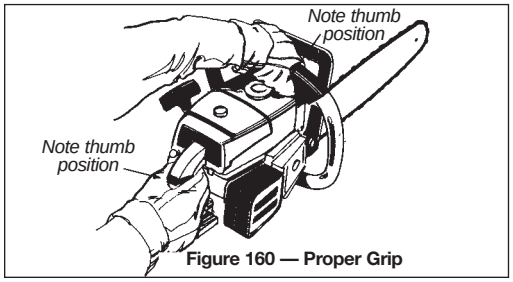
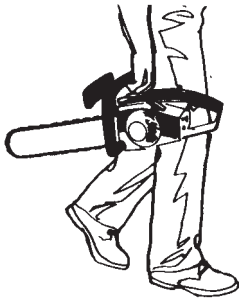


Figure 160 — Proper Grip



Before moving from place to place, shut off the saw and walk with the guide bar pointed backwards. A trip or a stumble with a running saw can cause serious injury.

obstructions. Use a quick, sharp motion on the starter pull (Figure 159). Never "drop start" the saw. This leaves only one hand to control a running saw and has resulted in leg cuts. Use the proper grip (Figure 160).

Site hazards

- Take extra care when making pocket cuts (Figure 161). 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 an alternative such as a sabre saw.
- Be particularly careful to avoid contact with nails, piping, and other metallic objects.

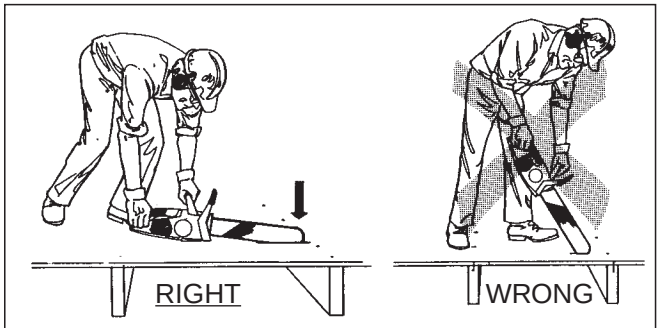


Figure 161 — Pocket Cuts

Maintenance

Well-maintained cutting components are essential for safe operation. A dull or improperly filed chain will increase the risk of kickback.

- Inspect and maintain your saw according to the manufacturer's recommendations regarding chain tension, wear, replacement, etc. Check for excessive chain wear and replace chain when required. Worn chains may break!

- Select the proper size files for sharpening the chain. Two files are necessary:

  1) a flat file for adjusting depth gauge

  2) a round file of uniform diameter for sharpening cutters and maintaining drive links.

- You must choose the correct round file for your chain to avoid damaging the cutters. Consult the owner's manual or the supplier to be sure of file size.
- A round file used in combination with a file holder or, better yet, a precision filing guide will give the best results (Figure 162).

Adjusting chain tension

- Follow the manufacturer's instructions on chain tension.
- In general, the chain should move easily around the bar by hand without showing noticeable sag at the bottom (Figure 163).
- Be generous with chain lubricating oil. It is almost impossible to use too much. Most late model saws have automatic oilers. **But operators must still remember to fill the chain-oil reservoir.**

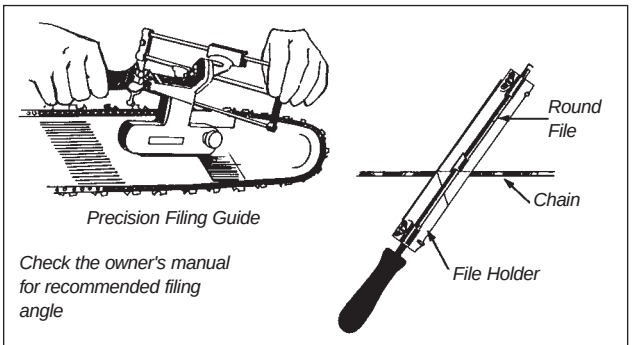


Figure 162 — Sharpening Tools

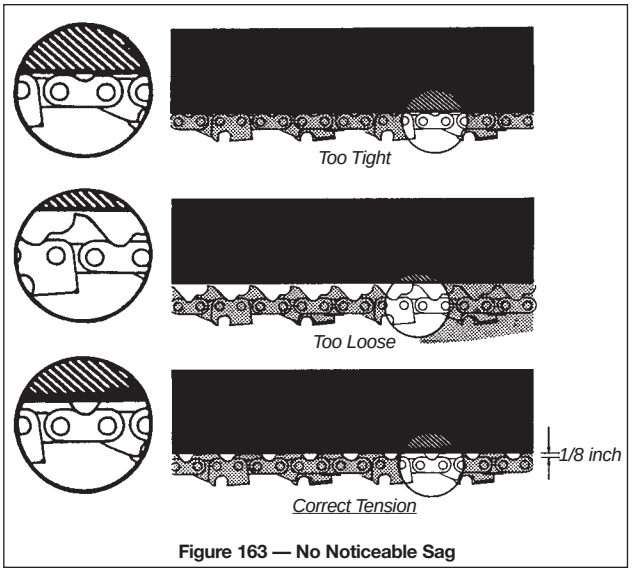


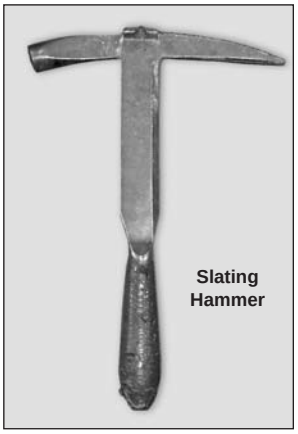
Figure 163 — No Noticeable Sag

Bench Stakes

- Lift safely to place the stake on the table.
- Make sure that stake is secure.

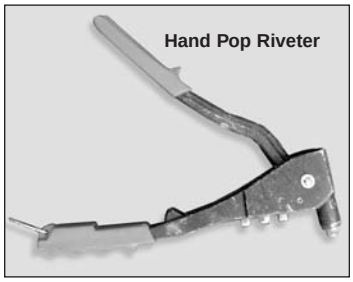
Slating Hammer

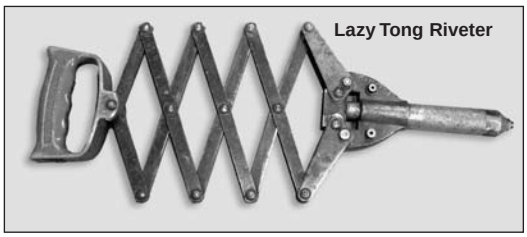
Safe practices with slating hammers are similar to those with other hammers (see the chapter on Hand and Power Tools in this manual).

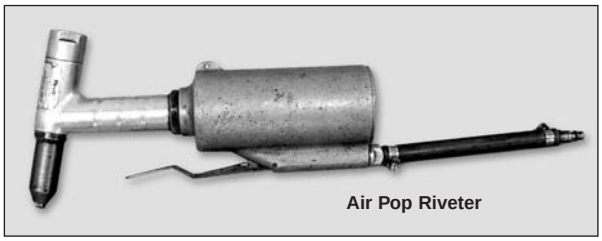


Riveters

Lazy tong riveters and pop riveters (hand and air) are used to insert fasteners (rivets) between two or more pieces of material to hold them together. Pop riveters are generally used for lighter-gauge material while lazy tongs are used for heavier-gauge material.







When using these tools, keep hands and fingers away from hinged parts (pinch points) and areas around the rivet.

For more information on a variety of tools, see the chapter on Hand and Power Tools in this manual.