Concrete Cutting Coring & Removal

CONSTRUCTION SAFETY ASSOCIATION OF ONTARIO

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This manual has been reviewed and endorsed by the Provincial Labour-Management Health and Safety Committee and is fully a document of accord between labour and management authorities.

In the past, members of the public have used printed information that was outdated by subsequent improvements in knowledge and technology. We therefore make the following statement for their protection in future.

The information presented here was, to the best of our knowledge, current at time of printing and is intended for general application. This publication is not a definitive guide to government regulations or to practices and procedures wholly applicable under every circumstance. The appropriate regulations and statutes should be consulted. Although the Construction Safety Association of Ontario cannot guarantee the accuracy of, nor assume liability for, the information presented here, we are pleased to answer individual requests for counselling and advice.

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1 INTRODUCTION

The cutting, coring, breaking, grinding and chipping of concrete is an everyday part of the construction scene involving a number of trades and a wide variety of power tools and equipment.

In well-trained hands and under normal circumstances, these tools offer little risk of injury. In recent years, however, almost 300 lost-time injuries were recorded in Ontario construction as a result of improper use of the tools, failing to wear the recommended protective equipment or problems meeting the physical demands of the tool in a given situation.

Concrete tool users suffered a high percentage of eye injuries (23% compared to 6% for all construction trades). This demonstrates a real need for protective eyewear when operating the tools. In addition, a higher than normal percentage of hand injuries indicates hazards which could be reduced by wearing work gloves.

This manual identifies the various types of tools currently in use, recommends how and where they should be used, and indicates the personal protective equipment and other safeguards appropriate to each.

The information will be useful as a training guide for journeymen and apprentices, and as a reference for supervision and management.

2 PREPARATION AND PLANNING

Before attempting to cut, core or remove concrete/masonry walls or floors, planning and preparation are required.

- Review as-built drawings for locations of embedded electrical, mechanical or piping systems.
- Review structural drawings for reinforcing steel, structural steel, anchors, lintels or similar embedments.
- Confirm the above information with occupants or owners.
- De-activate electrical or mechanical systems embedded in the work area.
- Don't presume that a circuit is dead because a switch has been pulled. Check it with a circuit tester.
- Drain mechanical systems to relieve pressure in the lines.
- Where cutting and coring will involve
  - a hole larger than 4 inches in a concrete slab
  - a concrete beam or column
  - embedded structural members, or
  - enlarging an existing opening

a professional engineer or person with technical competence in structural design should review the plans and inspect the site before work is started.

3 GENERAL SAFETY PRECAUTIONS

Tools and equipment with a similar power source will pose similar hazards, regardless of size or type. The following procedures should be observed by operators using electric or fuel powered equipment.

3.1 Combustion Engines – Gas or Diesel

Before operating any engine, check to ensure the following:

- ☐ Unit fuelled and cap securely in place.
- ☐ Correct fuel or fuel/oil mix in the tank.
- ☐ Engine oil at the correct level.
- ☐ Radiator at the correct level and cap secure.
- ☐ All drive and fan belts in good condition and properly tensioned.
- ☐ No loose, missing or damaged parts.
- ☐ Guards all in place.
- ☐ Air filters clean.

Do not run combustion engines in enclosed or confined spaces where exhaust gases can collect. Carbon monoxide gas is colourless and odourless, and can kill very quickly. In enclosed or confined areas, use an alternate power source such as electricity or compressed air.

Use only Canadian Standards Association or Underwriters' Laboratories certified fuel containers for storing and dispensing gasoline and diesel fuel. These containers bear the CSA, UL or ULC stamp.

Fires can be avoided by shutting off the engine and allowing it to cool down before fuelling. Use a funnel spout to prevent spills.

For further information, refer to "Portable Containers for Volatile Fuels and Solvents" (DS13) available from the Construction Safety Association of Ontario.

3.2 Electric Tools

When using electric tools observe the following precautions.

- Check extension cords and examine feed cord, switch and other components before using. If tool is double insulated, check motor casing for cracks or damage. Tag and return any defective tools to your supervisor.
- Protect extension cords from damage in traffic areas.
- Unless the tool is double insulated, the power source must be grounded. Power feeds must be approved three-wire cord with three-prong plugs and be used only in properly grounded three-pole receptacles. Never cut off or bend back the ground pin to allow use in a two-pole receptacle and never use cheaters (two-prong/three-pole adapters).
- Use only the extension cord gauges that suit tool amperage and cord length (see table below).
- Use a ground fault circuit interrupter (GFCI) to prevent shocks from faulty extension cords or tools. A GFCI will interrupt power if tools or extension cords leak current to ground. This is very important if cutting and coring equipment is being used in wet areas or water is being used to keep dust down.

USING DEFECTIVE TOOLS CAN BE A FATAL MISTAKE. DON'T BECOME A STATISTIC. INSPECT ALL TOOLS BEFORE USING. TAG AND RETURN DEFECTIVE TOOLS FOR REPAIRS.

Extension Cord Gauges for Electric Tools
(Based on 120 volt power supply)

Cord Length in Feet	Nameplate Amperes																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
25	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
50	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	12
75	14	14	14	14	14	14	14	14	14	14	14	14	12	12	12	12	12	12	12	12
100	14	14	14	14	14	14	14	14	14	12	12	12	12	12	12	10	10	10	10	10
125	14	14	14	14	14	14	14	12	12	12	12	12	10	10	10	10	10	10	10	8
150	14	14	14	14	14	14	12	12	12	12	10	10	10	10	10	10	8	8	8	8
175	14	14	14	14	14	12	12	12	10	10	10	10	10	10	8	8	8			
200	14	14	14	14	12	12	12	10	10	10	10	10	8	8	8					
225	14	14	14	14	12	12	10	10	10	10	8	8	8							
250	14	14	14	12	12	12	10	10	10	8	8	8								
275	14	14	14	12	12	10	10	10	8	8	8									
300	14	14	14	12	12	10	10	10	8	8										
325	14	14	12	12	10	10	10	8	8											
350	14	14	12	12	10	10	10	8												

American Wire Gauge (AWG), standard annealed copper wire, solid temperature 25°C (77°F).

Shaded area indicates combinations of amperage and length for which no extension cord gauge can be safely recommended.

4 CONCRETE BREAKING AND REMOVAL

The removal of large masses of concrete or masonry has mostly been assigned to heavy equipment such as backhoe-mounted air or hydraulic powered impact hammers. However, in many instances the contractor must still rely on manual methods because of the small amount to be removed or a restricted working space.

Therefore, this publication focuses on manually operated tools and equipment because they present the greatest risk of injury.

4.1 Air-Powered Jackhammers

Air-powered jackhammers are probably the most commonly used tool for removing concrete or masonry. The package consists of a compressor, air hoses, breakers and points. A light-duty breaker requires 45-50 cubic feet per minute (CFM) of air and operates at approximately 1,500 blows per minute. A heavy-duty breaker requires 80-85 CFM and delivers approximately 1,100 blows per minute. The weight of hand-held breakers will range from 40 to 80 pounds depending on size and make.

What are the causes of jackhammer accidents?

1) Overexertion due to improper lifting and handling of equipment. These are generally back injuries.
2) Eye injuries from flying particles.
3) Crush injuries mainly to hands and arms from getting caught between the tool and the work surface.
4) Foot injuries from contact with the breaker point.
5) Long term occupational illness.

How do such injuries happen and how can they be prevented?

4.2 Jackhammer Hazards and Safeguards

Overexertion Injuries

Obviously, care must be taken in assigning jackhammer work. This is a job for the stronger and heavier individuals in the crew. To put a 125-pound worker on an 80-pound breaker is inviting a lost-time injury. Secondly, careful attention must be given to the work surface. If rubble is allowed to build up around the operator's feet there is a good chance of a slip or trip. In addition, a sudden drop of the "gun" when cutting an exposed edge can put damaging loads on the operator's back and arms (Figure 1).

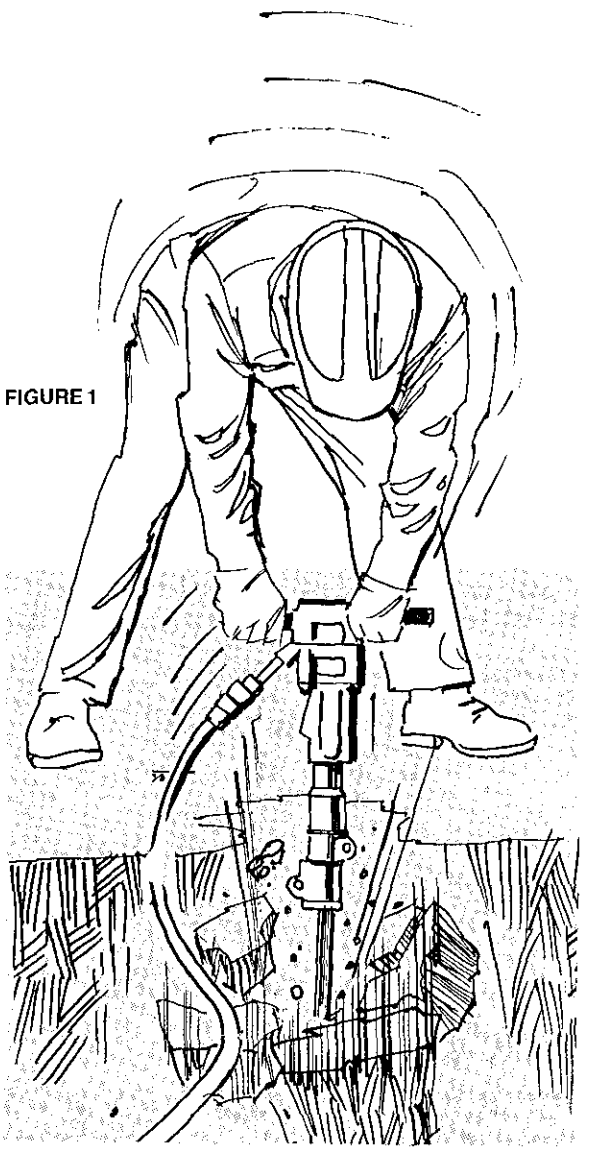


FIGURE 1

Probably the most fatiguing position is working against a vertical surface with the "gun" at or near the horizontal. With a heavy breaker this is a two-man job and even then additional precautions are required.

- Wherever possible, have the point make contact below waist level (Figure 2).
- Use care in starting a hole so that the point does not slip.
- Have a second worker support the lower half of the breaker with a rope or sling (Figure 2).

Wherever possible use an alternate method such as the backhoe-mounted breaker (Figure 3).

Eye Injuries

As a minimum requirement all operators of jack-hammers and all persons within 20 - 25 feet of the work face should wear safety goggles to prevent injury to the eyes. Under certain conditions a full face shield may be preferred.

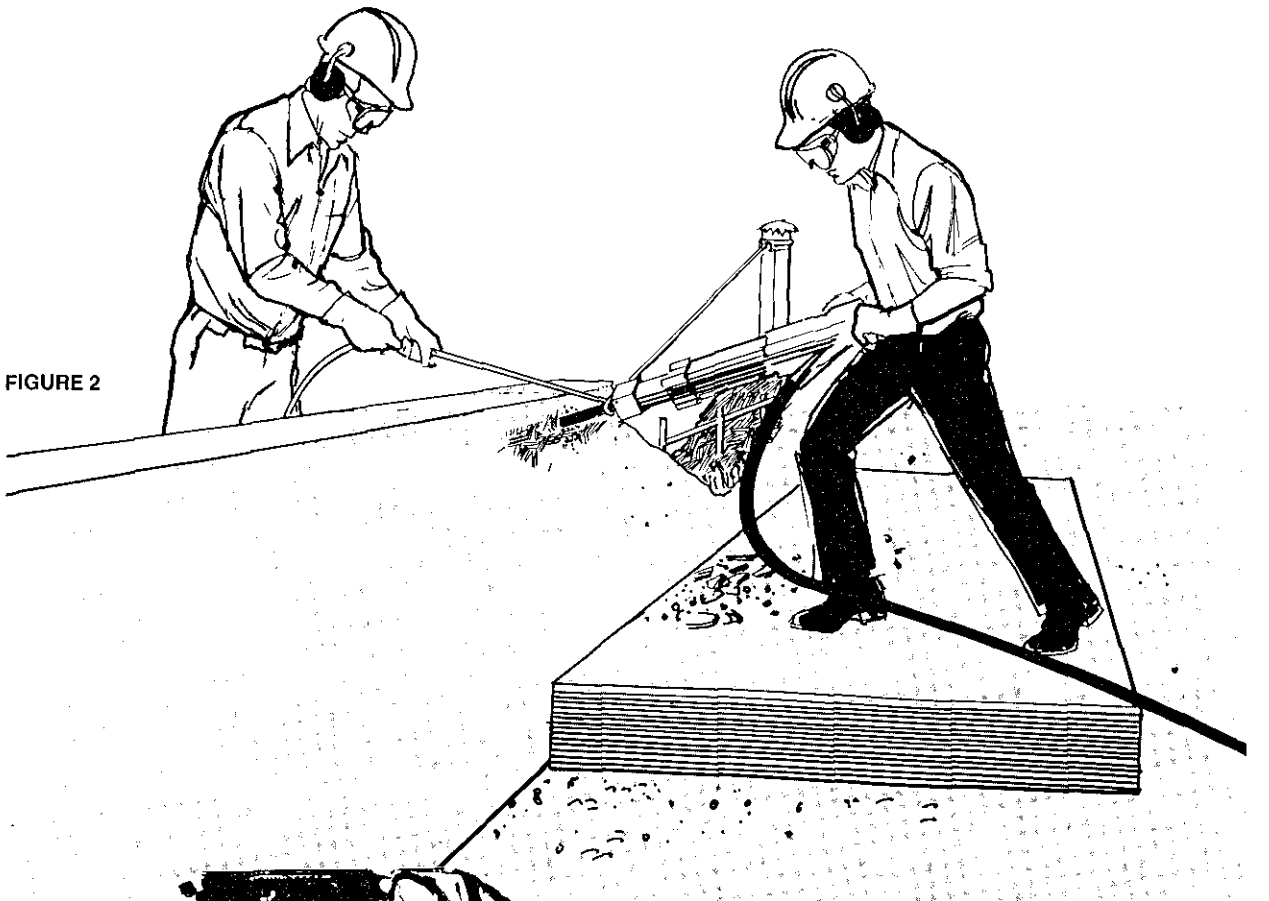


FIGURE 2

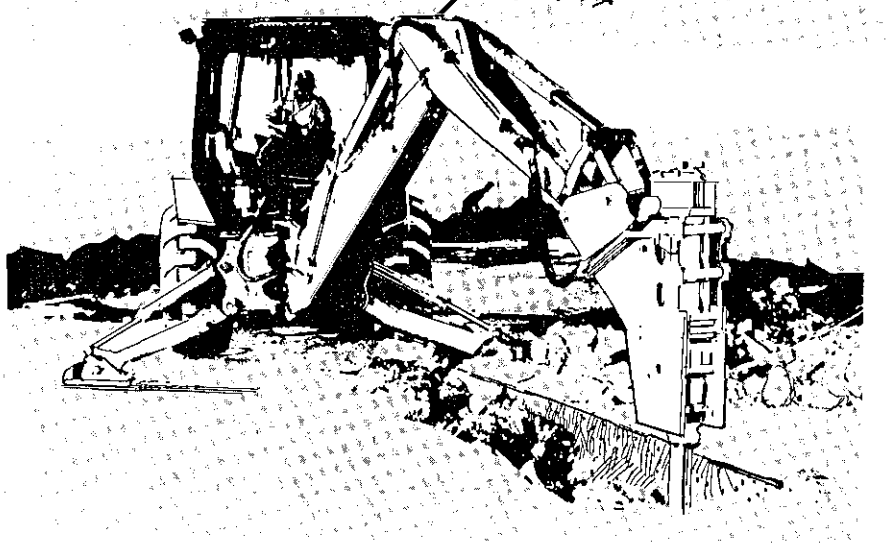


FIGURE 3

Crush Injuries

This type of injury generally results from a sudden slip of the breaker trapping the worker between the work surface and the tool.

To help prevent such accidents,

- Maintain a wide-legged stance to take up the shock of the point slipping unexpectedly.
- Give yourself room to work by removing obstructions before starting.
- Clear away rubble as you go.
- Wear heavy-duty leather gloves.

Foot Injuries

Many foot injuries are caused by the point breaking off because the operator tries to force the "gun". Other injuries occur when the point bounces off steel or cast iron embedded in the concrete.

Always wear safety boots with steel toe and sole protection. This will be CSA certified Grade 1 footwear for construction workers. Boots with metatarsal arch protection are recommended for workers who operate jackhammers. Boots should be laced to the top and tied snug above the ankle to prevent twists and sprains.

Long-Term Occupational Illness

There are three major occupational health hazards associated with air-powered jackhammers:

1) Hearing loss from prolonged exposure to noise.
2) Vibration White Finger Disease (Raynaud's Syndrome) resulting from excessive tool vibration absorbed into the hands.
3) Lung conditions due to long-term exposure to concrete dust.

1) **Hearing Loss** – Air compressors and jackhammers will generate noise between 95 and 115 decibels depending on the age and condition of the equipment and whether it is equipped with silencers. Prolonged exposure to noise levels exceeding 90 dBA is harmful. The following table illustrates the maximum exposures recommended for workers *not* wearing hearing protection.

Sound Level Decibels	Exposure Duration Hours Per 24-Hour Day
90	8
93	4
96	2
99	1
102	½
105	¼ or less
over 108	No Exposure Recommended

Only by wearing hearing protection around noisy equipment can workers be sure of protecting their hearing.

Hearing protection is available in three general types:

- disposable earplugs (use once and throw away)
- permanent earplugs (must be fitted to provide a good seal but can be washed and reused)
- earmuffs (when properly fitted they offer more protection than earplugs).

For more information, refer to "Hearing Protection for the Construction Industry" (DS16) available from the Construction Safety Association of Ontario.

2) **Vibration White Finger Disease** – This condition affects blood circulation and nerve endings in the fingers. Generally it is a progressive problem that begins as a minor annoyance – numbness and a tingling feeling in the finger tips. In later stages it becomes quite painful and can lead to gangrene. Workers affected by "white finger" will be more susceptible in cold weather. Gentle warming of the fingers is often the only relief.

At present, the best advice to workers susceptible to this condition is to always wear gloves while operating vibrating equipment.

Contractors are advised to ensure that tool handles are equipped with shock-absorbing pads and that operation of tools with excessive vibration is rotated within the crew to minimize exposure time.

3) Respiratory Damage

Removing concrete can release dusts very harmful to the lungs. Silica and chromium in particular are known to be hazardous. Damage to the lungs usually takes place over a long term but can vary with degree of exposure. A worker who removes concrete under very dusty conditions should wear a respirator or face mask suitable for filtering out dust particles.

Hosing the concrete with water will help to hold down dust.

For more information, refer to "Respiratory Protection for the Construction Industry" (DS17) available from the Construction Safety Association of Ontario.

4.3 Additional Precautions

Users of air-powered jackhammers should observe the following precautions.

- Where possible, set up the compressor on firm level ground. Overexertion injuries often result when workers try to move the compressor under difficult circumstances. Block the wheels to prevent rolling.
- Never use the air hose to blow dust and dirt from your clothing. Air pressure can drive particles into your skin causing infection.
- When hooking up air lines between compressor and breaker always secure quick-couplers with wire to prevent disconnecting. Accidental disconnection of a line under pressure can cause whip injuries.
- Do not leave compressors running unattended. If you must leave the area, shut them down until you return.
- Compressing air causes moisture buildup. Water vapour condenses as the air is cooled under pressure. As moisture can interfere with operation this may require bleeding the air tank on some models, or the use of antifreeze in cold weather to prevent erratic operation of the tools.
- Always shut off the air supply and release the air in the lines before disconnecting fittings.
- After the compressor is shut down, relieve the air pressure by opening the valve on the storage tank.

4.4 Hydraulic and Electric Jackhammers

In recent years hydraulic and electric jackhammers have been introduced to construction (Figure 4). While not as powerful as air-jackhammers of comparable weight, the units have obvious advantages over air equipment. For instance, they produce much less noise and are portable enough to be used in tight quarters.

In general, the safety considerations that apply to air-breakers also apply to hydraulic or electric breakers.

FIGURE 4

4.5 Non-Powered Hand Tools

Occasionally, a worker will be faced with breaking out concrete or masonry with hammer and chisel. This oldest of methods results in numerous injuries but, with the proper tool selection and a few basic rules, can be done quite safely.

For personal protection, always wear safety glasses and/or a face shield to protect against flying chips. Wear work gloves with good grip to protect the hands.

Choose the correct style and weight of hammer. Use mash hammers or short-handled sledgehammers in the 2 to 4 pound class for one-handed work, and long-handled sledgehammers in the 6 to 14 pound range for two-handed work. Bull points and chisels should be between 8 and 16 inches long with a shank diameter of at least 3/4 inch.

Points and chisels should be high quality steel kept sharp "as new". The striking end of the shank should be dressed from time to time to remove any mushrooming (Figure 5).

Chisels and points should be held with tongs to prevent injuries to hands. This is particularly important when workers perform as a team – one holding the chisel and the other swinging the hammer (Figure 6).

Hammers with damaged or loose handles should be removed from service until repaired.

Select the proper chisel/bull point for the job. Points are superior for removing concrete because of their shattering qualities. Chisels should only be used for trimming edges or separating masonry joints.

FIGURE 5

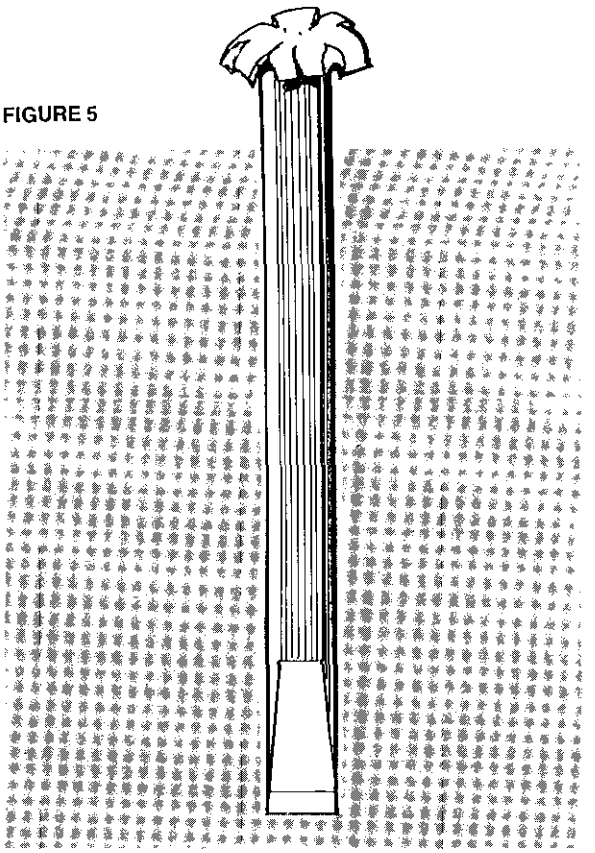
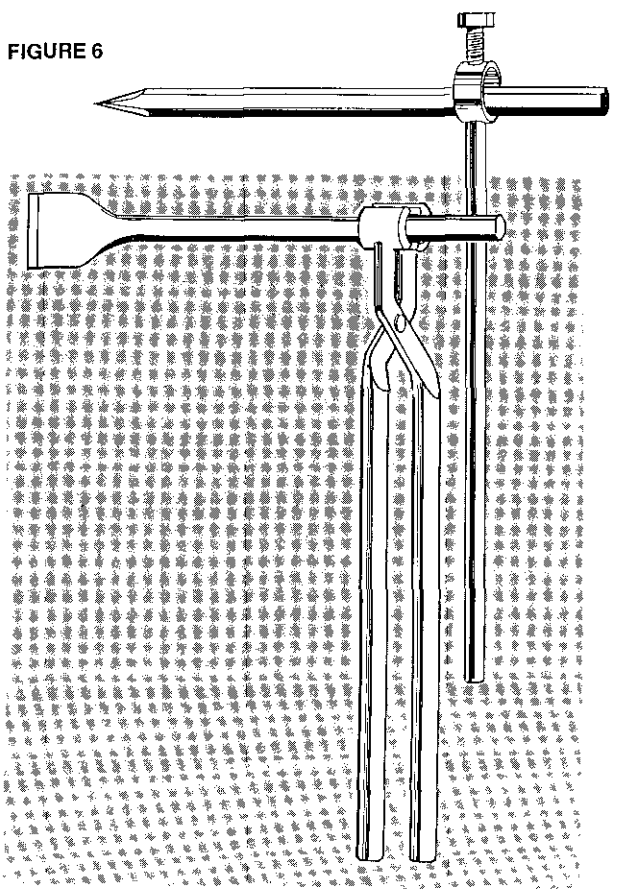


FIGURE 6



5 CONCRETE SAWING

5.1 Concrete Saws

Concrete saws have become the tool of choice for cutting openings in concrete floors and walls and for cutting contraction joints in new concrete slabs. Saws are available in a number of styles – hand-held, self-propelled, track-mounted – and in a number of power modes – gas, diesel, electric, compressed air or hydraulic (Figures 7, 8, 9).

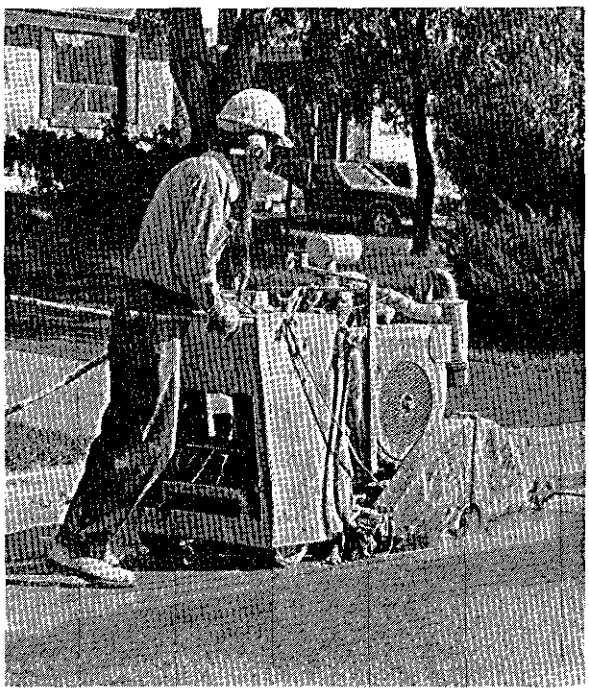


FIGURE 7

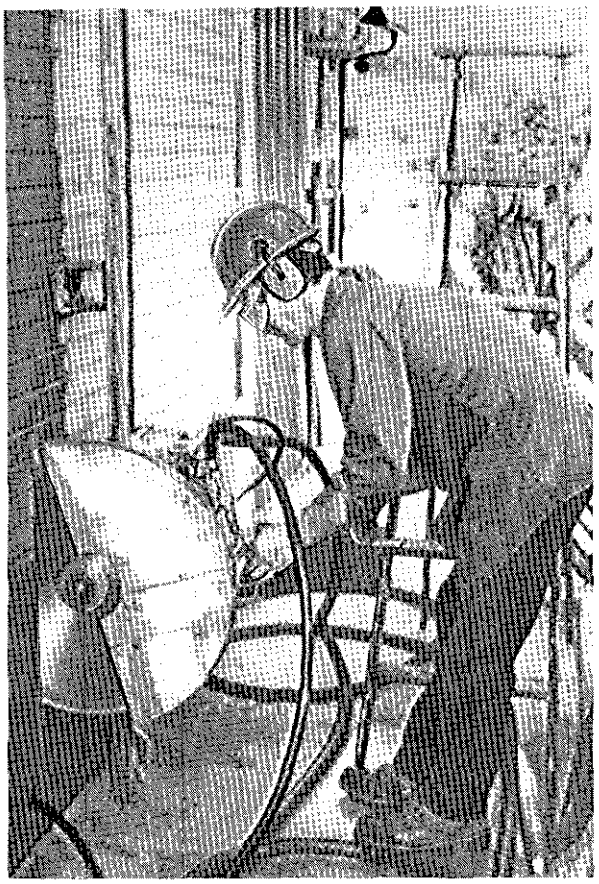


FIGURE 8

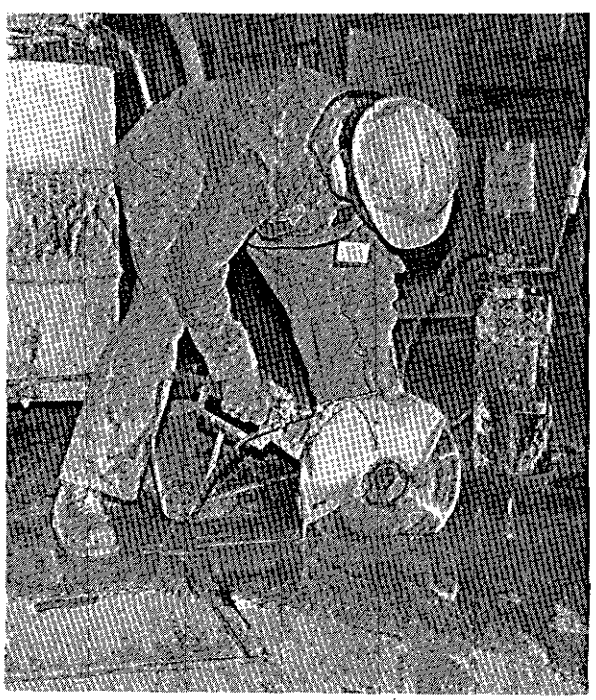


FIGURE 9

Cutting is done with a circular blade revolving at high speed. Three main types of blade are used:

- the wet-cut diamond blade
- the dry-cut diamond blade
- the dry or wet-cut carborundum blade.

5.2 Concrete Saw Hazards and Safeguards

The hazards associated with the use of concrete saws involve six major factors:

- Overexertion injuries from lifting the saws on and off transport and from using them repeatedly.
- Contact with a moving saw blade.
- Hearing damage due to high noise levels.
- Eye injuries from flying particles.
- Exposure to high dust levels.
- Slips and falls on slippery work surfaces.

Overexertion

The larger walk-behind saws require proper transport. Ideally, the bed on the vehicle or trailer should be close to the ground and provided with ramps. Trucks equipped with power tailgates or lifting booms can also be useful for handling the larger saws.

Hand-held saws such as the quick-cut saw are commonly used because of their portability and low cost. However, operation over long periods can be very tiring because of the posture required. A wheeled stand is recommended not only to eliminate bent posture but to increase control over the saw (Figure 10).

While larger saws are equipped with electric starting, many of the small and medium units must be pull-started. A badly tuned engine can make starting very difficult, and lead in turn to exertion injuries such as lower back strain or pulled shoulder and arm muscles.

To reduce the risk of overexertion keep equipment in good operating condition. Inspect saws carefully for loose or damaged parts before using. Clean and gap spark plugs regularly to ensure proper ignition. Replace any electrical components that appear pitted, weak or frayed. Clean fuel and air filters as recommended in the owner's manual.

Contact with Moving Blade

Concrete saw blades may not have teeth but they can still bite. Revolving at average speeds of 3000 rpm an exposed blade can cause serious injury. Keep blade guards in place and in

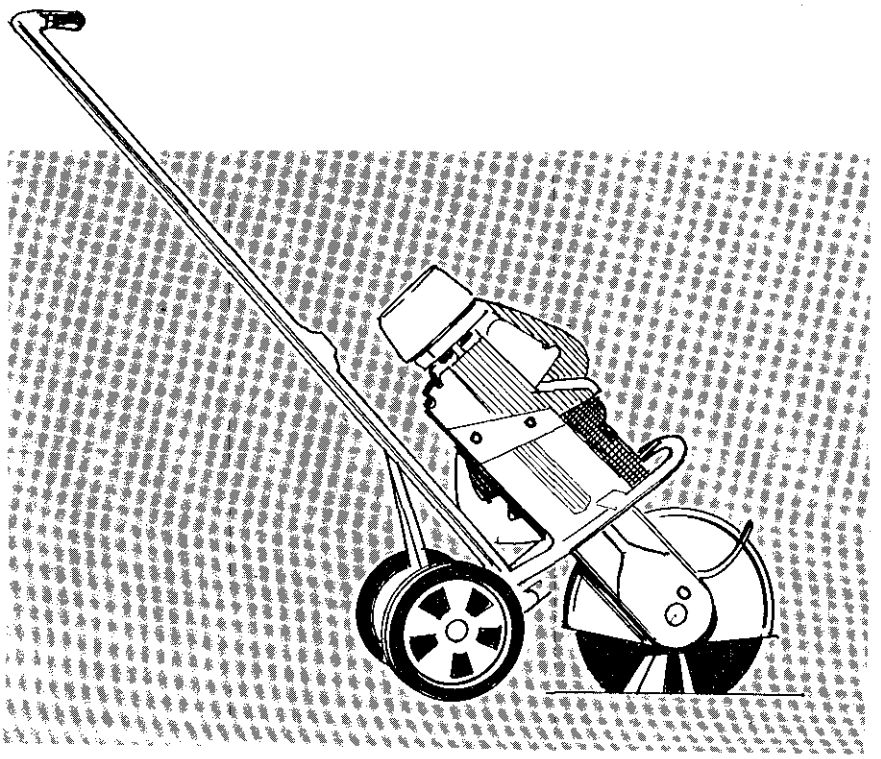


FIGURE 10

good condition. Keep bystanders clear of the work area. When operating hand-held saws use care and maintain control to prevent contact with legs and feet. Always keep a two-handed grip on the saw while cutting.

Hearing Loss

Concrete saws produce excessive noise levels which can be exaggerated by faulty mufflers. Hearing protection is recommended for everyone working close to concrete saws. See recommendations on page 8 for guidelines to exposure levels and hearing protection types.

Eye Injuries

Both wet and dry cutting can expose workers to eye injury from flying particles. To minimize this hazard, keep guards in place and wear eye protection. Goggles offer the best protection by totally enclosing the eye area.

Respiratory Exposure to Concrete Dust

Dry cutting, especially in enclosed areas, can produce excessive amounts of airborne dust. If wet cutting is impossible and exposure will be long-term, operators should wear respiratory protection. While throwaway face masks will do the job, they are expensive when used in quantity. A filter cartridge respirator will provide better and less expensive protection to operators. Respirators need daily maintenance to keep them hygienic and in good condition. Filter cartridges should be replaced as they become difficult to breathe through and the face piece should be washed and dried at the end of each shift. Store the respirator in a plastic bag and keep it sanitary. For further information, refer to "Respiratory Protection for the Construction Industry" (DS17) available from the Construction Safety Association of Ontario.

Slips and Falls

The slurry created by cooling water and concrete dust can lead to slippery walking surfaces. This is especially a hazard where worn boot treads are combined with a highly finished concrete floor. Clean the work area as you go with a long-handled squeegee. In addition, many contractors use wet vacuums to pick up water as cutting progresses.

5.3 Additional Precautions

Saw operators should also take the following precautions.

- All exposed moving parts on the saw should be guarded. This includes not only the revolving blade but drive belts and pulleys as well.
- Wear close-fitting clothing. Avoid dangling jewelry, loose shirts, belts and scarves that can be caught and pulled into operating machinery.
- Never crowd the saw. Maintain just enough pressure to keep the saw moving.
- When using abrasive blades, make cuts in stages. For example, to make a cut 6 inches deep it is less damaging to both the saw and the blade to make six passes, cutting one inch deep each time.

- Look for signs that the sub-base supporting a slab has settled. A large hollow under a floor can let the slab drop in mid cut without warning (Figure 11). This usually jams the blade, throwing off segments at high speed. If water drains rapidly away down the saw cut, the slab probably has a hollow. Before cutting check by tapping the concrete with a hammer and listening for a hollow sound.
- When cutting openings in concrete or masonry walls, the section to be removed should be supported to prevent accidental toppling (Figure 12).

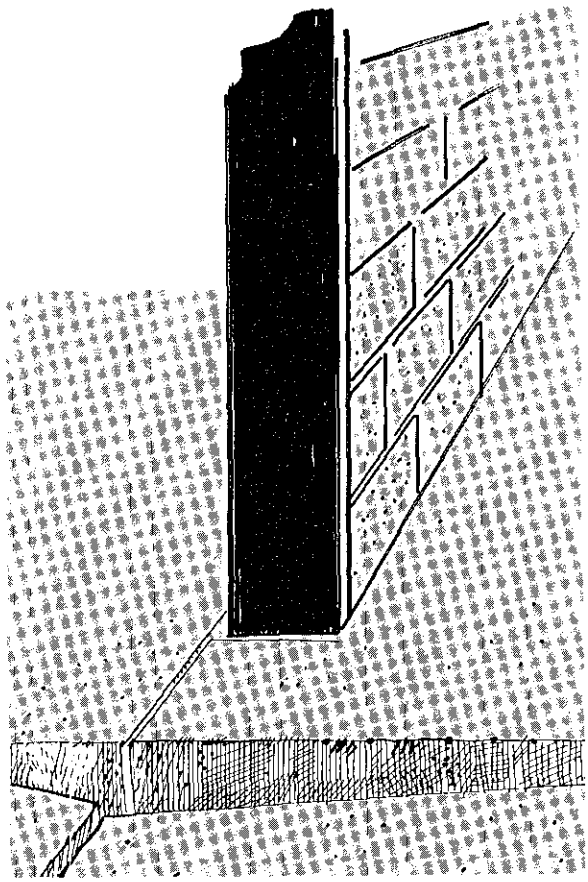


FIGURE 11

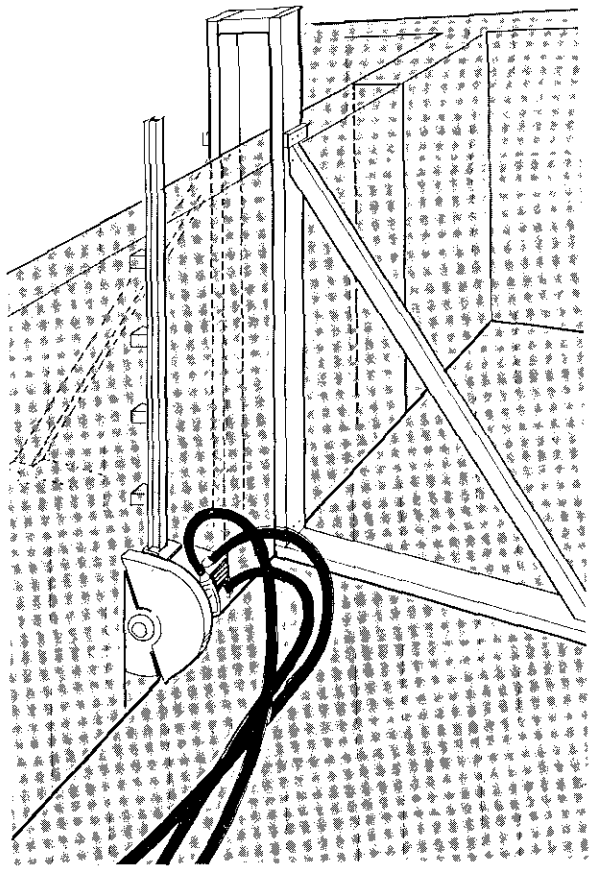


FIGURE 12

- When using a quick-cut saw, avoid gasoline spills on clothing. A hot metal spark from rebar or embedded ironwork can be enough to ignite clothing. Make sure the cap fits securely on the gas tank and has a leak-proof gasket. Don't use makeshift substitutes. If the cap is lost, get a replacement.
- On quick-cut saws, blades rotate forward and down. To avoid fighting the natural rotation of the saw, start the cut at full arm extension and draw the saw towards you.
- Abrasive blades for walk-behind and hand-held saws are designed for edge cutting. Never use the side of the blade as a grinder. This can cause the blade to shatter.
- Water cooled blades must have a constant supply of water (between 2½ and 5 gallons per minute). An interruption in water supply can quickly overheat the blade and cause shattering, segment fly-off or core damage. Water hoses should be inspected for kinks, collapsed sections and damaged fittings. Pumps, valves and fittings on the saw should be cleaned frequently to prevent the buildup of scale and sediment. Source water should be clean enough to prevent lines from becoming blocked.
- With water-cooled diamond blades use only the minimum diameter blade necessary to make the cut. To use a larger blade is wasteful and can undercut the steel core. This is most often caused by cutting into sand and gravel sub-base, and by not using enough cooling water to flush abrasives away from the steel blade core.
- Undercutting damage and possible loss of segments can also occur from cutting on a side slope. The weight of the saw causes the blade to ride on the downslope side of the cut. If possible, level the saw by planking the lower track.
- No one should stand in front of an operating saw. If segment loss occurs, fragments will fly as much as 30 feet in a forward direction.
- Dry-cut high-speed diamond blades have been introduced for use on hand-held quick-cut saws. This type of blade should never be used on a walk-behind saw. Hand-held saws are operated intermittently and the blades have a chance to cool. Walk-behind saws generally heat up faster and run longer. This can quickly damage the steel core and often results in segments flying off.
- Reducer bushings should be avoided on all blade types. Use only a blade with the correct arbor hole size to fit your saw.
- The blade on quick-cut saws should stop turning when the throttle trigger is released. If the blade continues to turn or the saw won't idle, have it adjusted.
- Always remove both abrasive and diamond blades before transporting or storing the saw to avoid blade damage.
- When using electric saws with water feed attachments, the saw should be double insulated or properly grounded with a three-prong plug. The circuit should be equipped with a GFCI to prevent shock if current leaks to ground.

5.4 Masonry and Tile Saws

Though not strictly in the same class as concrete saws, bench-mounted masonry saws and tile saws share many of the same characteristics. For safe trouble-free operation observe the following.

- Set the saw up on a firm level base.
- Keep the water tray filled to the proper level to maintain water circulation.
- Clean the water pan once or twice daily and refill with clean water.
- Use only properly grounded electric outlets and hookups.
- Use a GFCI at the outlet to prevent electrical shock.
- Always keep the guard on the blade when the saw is in use.
- Use only abrasive or diamond blades specified for the model of saw and the type of material to be cut.
- Keep the work area around the saw clear of cutting rubble.
- Wear eye protection. Safety goggles are the best choice for this tool.
- Don't force the saw. Keep a steady pressure but let the blade cut at its own speed.
- If the saw is factory-equipped with skids leave them in place to provide a stable, easy to transport work table.
- When using the saw for dry cutting, wear a dust mask to prevent respiratory contamination.

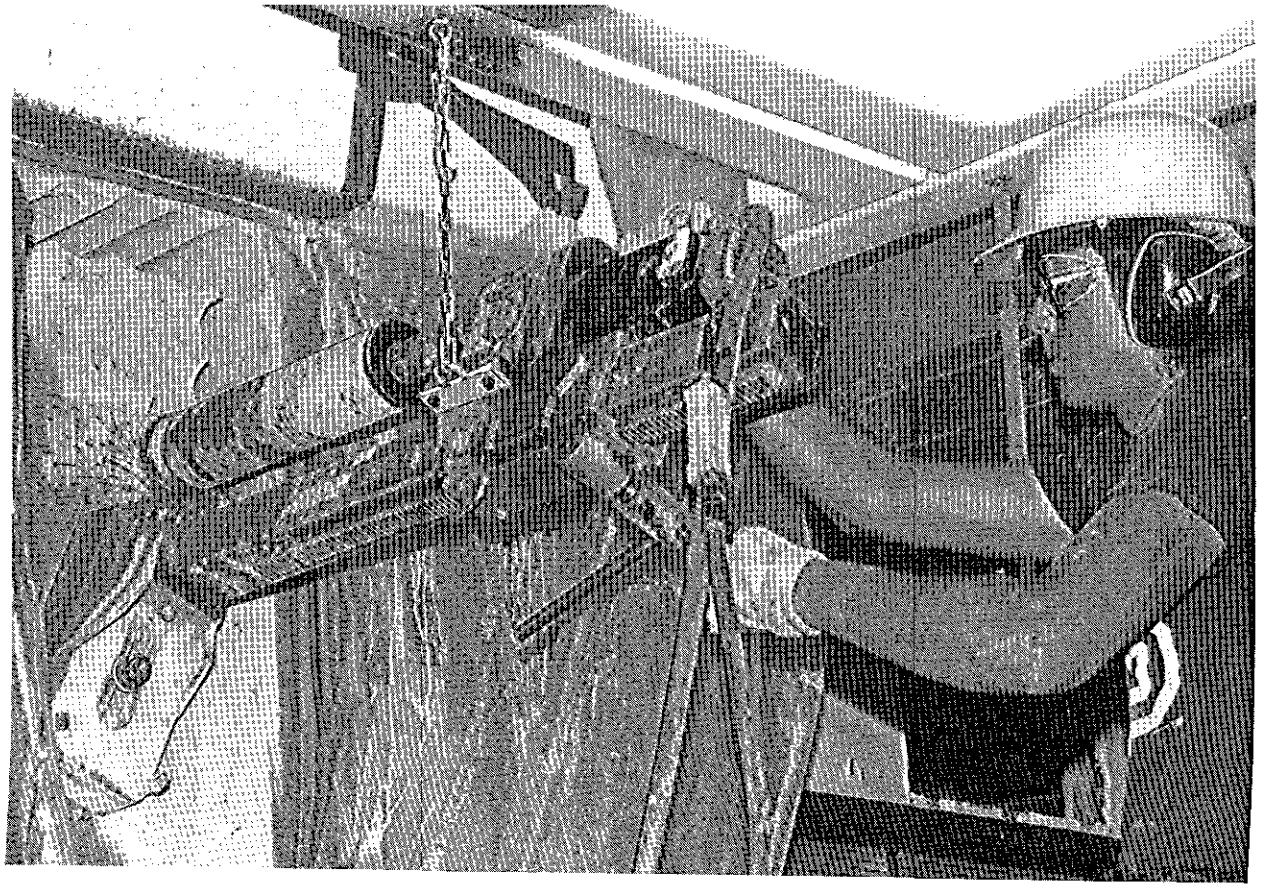
6 CONCRETE CORING AND DRILLING

6.1 Core Drills (Hole Saws)

Most diamond core drills or hole saws are electric powered and require a constant spray of water on the cutting head for cooling. For this reason a number of precautions are necessary to protect the operator.

- Observe the precautions for electric tools in Section 3.2.
- *Use a wet vacuum to clean up wastes from the* drilling head.
- Wear protective equipment to meet individual job requirements. This will generally consist of safety glasses or goggles, work gloves, and rubber boots with sole and toe protection.
- Hearing protection is recommended, especially for work in enclosed areas.
- Hole saws should be secured to the cutting surface before drilling begins. Bolt, shore or vacuum-clamp the unit in place to provide a stable drilling platform and prevent binding of the core drill.
- When drilling a vertical surface don't depend on the clamp to hold the unit in place. The unit must be supported from above by a safety cable or chain (Figure 13). Otherwise use anchor bolts.
- When core drilling floors above grade, protect the area below. Concrete cores usually drop out of the drill on completion of the cut. Rope off the area underneath and post warning signs. Remove any materials or equipment that could be damaged.
- With large cores it may be necessary to station a helper underneath to receive the core when it is released, and to ensure that the area is clear of other workers.

FIGURE 13



6.2 Impact Drills

Impact drills, hammer drills or roto-hammers as they are often called are widely used on construction by a number of trades to bore small diameter holes into or through structures.

This type of drill can be fitted with tungsten/carbaloy tipped drill bits or, for holes larger than one inch, with coring bits. Impact drills differ from standard electric drills in that drilling is done with a two-way action. The bit or core rotates and at the same time pulses against the cutting face with a hammer-like action (Figure 14).

Larger models can be equipped with a chisel bit to do demolition work, functioning as a small jackhammer.

6.3 Drill Hazards and Safeguards

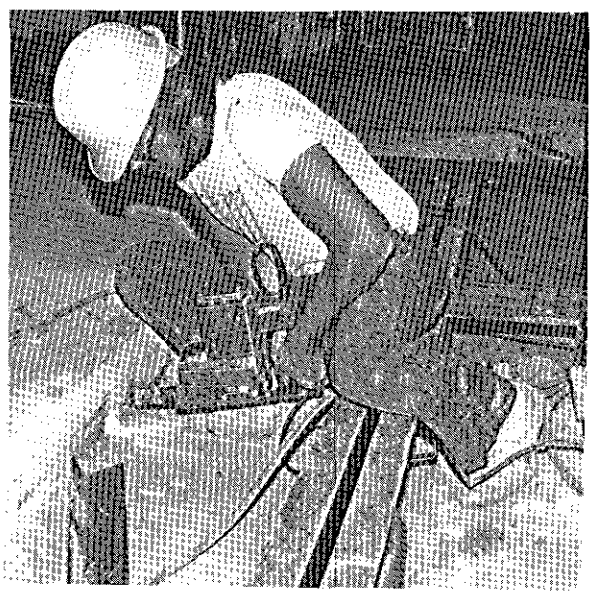
The hazards associated with these tools fall in three main groups:

1) Eye injuries from airborne dust and concrete chips.
2) Torsion injuries – strained ligaments and muscles as a result of the drill bit jamming and throwing the operator.
3) Electrical hazards associated with the use of defective tools and equipment.

Eye Protection

Safety goggles give the best wrap-around protection from flying particles. Safety glasses with side shields offer some protection but are not as effective.

FIGURE 14



Torsion Injuries

A jammed drill bit on a high performance impact drill can easily cause serious injury.

This hazard can be reduced or avoided altogether if the following precautions are taken.

1) Inspect the work area before starting and remove obstructions, if possible.
2) Don't overpower. Choose a drill that matches the job – adequate for the bit size and speed required.
3) Hold the tool with a firm two-handed grip, arms spread slightly to widen the stance. Anticipate trouble by keeping a firm, even tension on arm muscles ready to react to a jam.
4) Work the tool at a comfortable level – between waist and shoulder height when drilling walls and without overreaching when drilling overhead.
5) Avoid ladders. Working from a scaffold provides better footing and less chance of a fall should the drill bit jam.
6) Clean the drill-hole frequently by withdrawing the rotating bit from the work.

Electrical Hazards

Observe the safety precautions in Section 3.2. In particular, inspect or test all electrical tools and fittings for defects **before** using.

DON'T USE DEFECTIVE ELECTRICAL EQUIPMENT.

7 CONCRETE CHIPPING AND SCABBLING

This section covers a range of tools widely used to remove layers of concrete. Generally, such work will be done to remove

(a) a high spot or

(b) defective or decayed concrete before patching.

Most of the equipment in this category is air-driven, although some pieces may be hydraulic or electric powered.

7.1 Concrete Chippers

The chipper shown in Figure 15 is generally used for remedial work. Air-powered, it is useful for removing concrete up to a two-inch depth. Because it is hand-held it allows good control and can be worked on most surfaces and in fairly confined areas.

The needle chipper (Figure 16) is used for removing foreign matter from concrete to provide an improved bond between pours. This air-powered tool can be worked close to reinforcing steel.

7.2 Scabblers

Usually air-powered, the scabbler is a walk-behind unit consisting of multiple impact heads which strike the concrete with a piston-like action. The machine is very useful for removing a controlled amount of concrete from large floor areas.

FIGURE 15

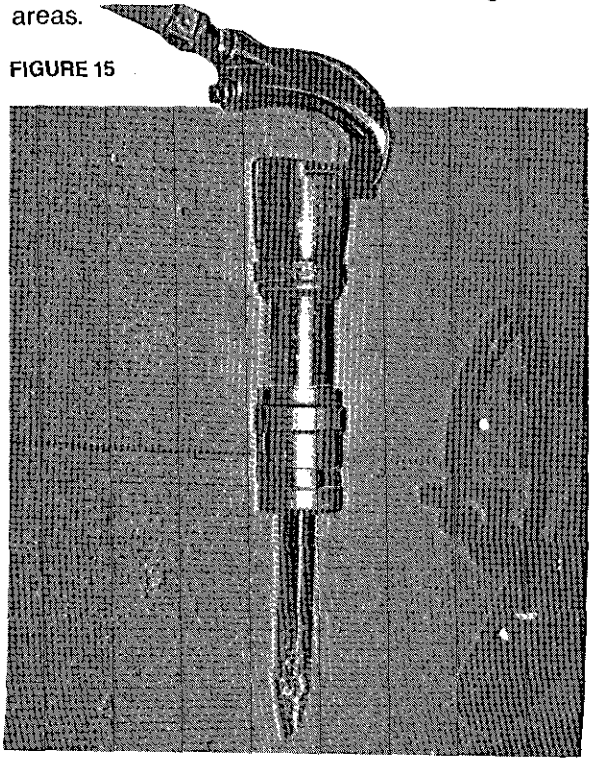
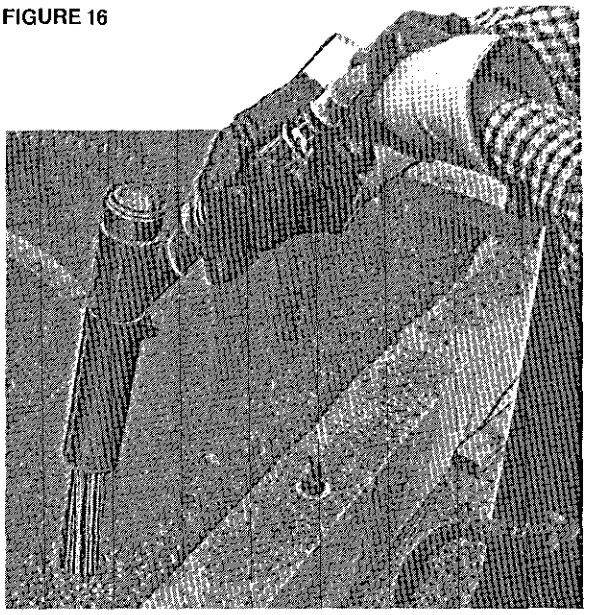


FIGURE 16



7.3 Chipper/Scabbler Hazards and Safeguards

The hazards associated with chippers and scabblers include

- eye injury due to flying particles
- hearing damage due to prolonged exposure to excessive noise
- respiratory irritation due to exposure to concrete dust
- hand injuries.

Eye Protection

Wear safety goggles when operating or working close to the equipment. In some instances a full face shield may be preferred.

Hearing Protection

Follow the guidelines for jackhammer work on page 8. While noise levels are not as severe, exposure time in many cases will be longer.

Respiratory Protection

While the use of chippers does not usually require a dust mask, scabblers can generate large quantities of dust even though equipped with a water spray attachment. Wear a respirator or dust mask suitable for filtering out dust particles. Change filter elements or replace throwaway dust masks at least daily.

Hand Injuries

Generally these result from hands or fingers being pinched between the chipper and another object. Heavy work gloves are recommended to help prevent such injuries.

8 CONCRETE GRINDING AND MASONRY TUCKPOINTING

Generally there are three types of concrete grinders:

1) the self-contained hand-held grinder (Figure 17)
2) the flex-shaft grinder with remote power source
3) the walk-behind floor grinder.

Grinders should only be used to remove thin layers of material. Removing more than 5-6 mm (1/4 inch) is not practical and requires another method. Grinders should be used to smooth surfaces, remove formwork fins and other defects and generally touch up finished work.

8.1 Grinder Hazards and Safeguards

The main risks inherent in the use of grinders are

- eye injury
- contact with a revolving stone
- being struck by a shattered stone
- electrical hazards
- dust exposure.

Eye Protection

Eye protection in the form of safety goggles is recommended for concrete grinding. This is especially the case when water is used.

Accidental Contact

Cup grinders revolve at speeds up to 3,800 rpm. Skin contact with the cup can result in serious cuts and abrasions. Guards should always be in place when the tool is being used. The operator should wear work gloves and keep a firm two-handed grip on the tool.

Shattered Stone

Inspect grinder stones before use. Look for obvious flaws or cracks. Never use a stone that has fallen on a hard surface. Don't overtighten the lock nut when installing the stone. Use only the size of stone or disc recommended for your grinder. If a stone of greater diameter is used, the increased surface rpm can cause shattering. **Never operate the tool with the guard removed.**

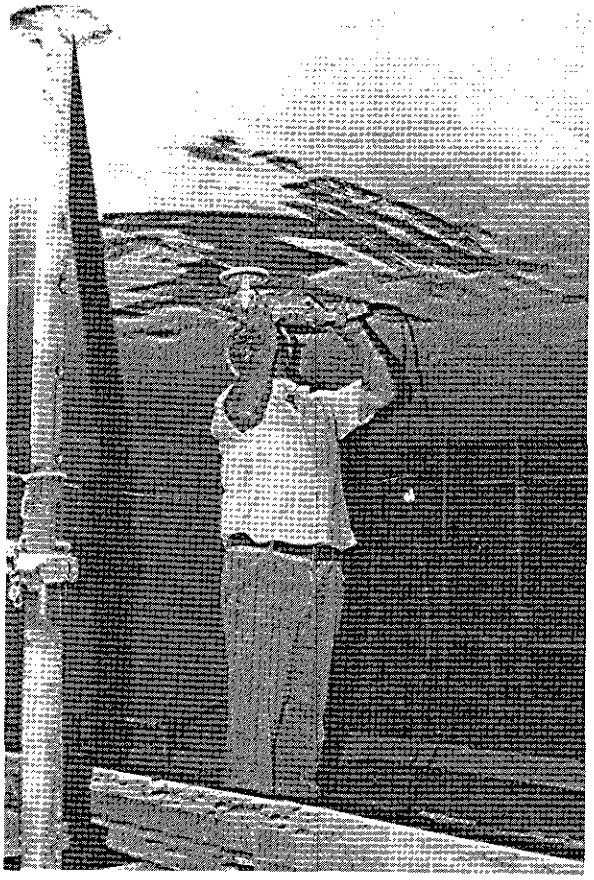


FIGURE 17

Electrical Hazards

Observe the precautions in Section 3.2. Grinders must be properly grounded, and GFCI's are recommended.

In addition, grinder operators should keep power cords clear of the grinding head to avoid damage and shock.

8.2 Tuckpointing

In addition to dressing concrete surfaces, grinders are widely used in masonry repair work.

Mini-grinders with a small flat disc suitable for concrete products can efficiently remove decayed mortar joints. But the work must be done with caution to prevent injury from a kickback or a shattered disc.

- Never use a disc grinder for tuckpointing with the guard removed.
- Safety goggles should be worn for closeup work. In some cases, a full face shield may be preferred.
- Keep two-handed control of the tool and give the work your undivided attention.
- Beware of masonry joints narrower than the width of the disc. The hardness of the surrounding masonry can cause the blade to jam and kick back or shatter.

9 DERMATITIS

A common risk in all concrete cutting, coring and removal is cement dermatitis. This can be a very serious skin disease and in extreme cases can force a worker to find other work.

Cement dermatitis is an allergic reaction to ingredients in portland cement, and can result in severe skin rashes or sores that are difficult to heal.

During concrete cutting and coring, the skin is exposed to wet cutting particles, although cement dust can combine with sweat to create a similar exposure.

Precautions include personal hygiene and sensible work clothing. Clothing should be laundered frequently to remove cement particles. Wash dust or paste off exposed skin at the jobsite. A lanolin cream can provide a barrier on the skin. Don't work in shorts or sleeveless shirts and wear work gloves to protect your hands.

10 SUMMARY

The safe operation of concrete cutting, coring and removal equipment depends on ten basic steps.

1. Inspect equipment before using. Don't use defective tools – tag and remove them from service.
2. Always wear the appropriate eye protection when working with or near the tools.
3. Wear hearing protection where indicated.
4. Control dust levels or wear respiratory protection, either a dust mask or a respirator.
5. Protect your hands by wearing work gloves.
6. Do not operate tools with guards removed.
7. Protect yourself from electrical hazards by using a GFCI.
8. Ensure a safe working surface by cleaning up debris and slippery cutting waste as work proceeds and by choosing a steady work platform (for instance, scaffolds instead of ladders).
9. *Choose the tool that's right for the job – the proper type, size and power source.*
10. Finally, for supervisors, choose the right person for the task – a worker who has been fully trained in the operation at hand.

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