CODE OF PRACTICE

CONCRETE AND MASONRY CUTTING AND DRILLING COMMISSION

Government of Western Australia

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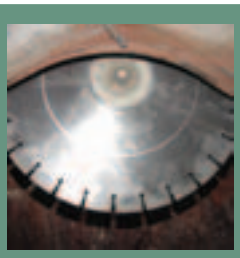
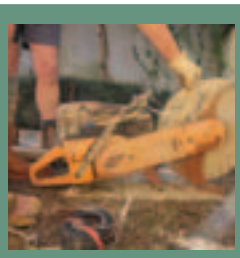
CONCRETE AND MASONRY CUTTING AND DRILLING

2004


COMMISSION FOR OCCUPATIONAL SAFETY AND HEALTH

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2004

COMMISSION FOR
OCCUPATIONAL
SAFETY
AND HEALTH

FOREWORD

The Occupational Safety and Health Act 1984 **established the Commission for Occupational Safety & Health which comprises representatives of employers, unions, government and independent experts. The Commission has the function of developing the legislation and supporting guidance material and making recommendations to the Minister for implementation. To fulfil its functions the Commission is empowered to establish advisory committees, hold public enquiries and publish and disseminate information.**

The Commission's objective is to promote comprehensive and practical preventive strategies that improve the working environment of Western Australians.

This code of practice has been developed through this tripartite consultative process and the views of employers and unions along with those of government have been considered.

THE ACT

The Occupational Safety and Health Act 1984 provides for the promotion, co-ordination, administration and enforcement of occupational safety and health in Western Australia.

With the objective of preventing occupational injuries and diseases, the Act places certain duties on employers, employees, self-employed persons, manufacturers, designers, importers and suppliers.

In addition to the broad duties established by the Act, it is supported by a further tier of statute, commonly referred to as regulations, together with lower tiers of non-statutory codes of practice and guidance notes.

Regulations

Regulations have the effect of spelling out the specific requirements of the legislation.

Regulations may prescribe minimum standards to be achieved or prescribe what must be done in respect of recognised hazards at work.

Regulations may also be for the licensing or granting of approvals, certificates, etc.

Codes of Practice

A code of practice is defined in the Act as a document prepared for the purpose of providing practical guidance on acceptable ways of achieving compliance with statutory duties and regulatory requirements.

Codes of practice:

- should be followed, unless there is another solution which achieves the same or better safety or health result; and
- can be used to support prosecution for non-compliance.

Guidance Notes

A guidance note is an explanatory document approved by the Commission providing detailed information on the requirements of legislation, regulations, standards, codes of practice or matters relating to occupational safety and health.

This code of practice was approved pursuant to section 57 of the *Occupational Safety and Health Act 1984* by the Hon Minister for Consumer and Employment Protection on 28 January 2004.

Scope

This code applies to all workplaces in Western Australia covered by the *Occupational Safety and Health Act 1984*.

It provides practical guidance for users and operators of concrete and masonry cutting and drilling equipment on carrying out their duties under the *Occupational Safety and Health Act 1984* and meeting the requirements of the *Occupational Safety and Health Regulations 1996*.

The code will apply to all workplaces covered by the Act where concrete and masonry cutting and drilling equipment is used and should be used by all persons involved in concrete and masonry cutting and drilling, employers, contractors, employees, self-employed persons, safety and health representatives and the designers, manufacturers, importers and suppliers of the plant.

For further information on this code of practice, contact the Chamber of Commerce and Industry of Western Australia (Tel. (08) 9365 7577), UnionsWA (Tel. (08) 9328 7877) or WorkSafe (Tel. (08) 9327 8777).

The Commission for Occupational Safety and Health appreciates the assistance of the following in the development of this code of practice:

The Victorian WorkCover Authority

Construction Skills Training Centre

Division of Workplace Health and Safety of the Queensland Department of Industrial Relations

Construction Forestry Mining and Energy Union (CFMEU)

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Introduction

People using concrete and masonry cutting and drilling equipment face a wide range of hazards, such as silica dust, toxic exhaust fumes, saw kick-back, blade fracture, falling walls, electrocution, vibration, noise, slips, falls and manual handling.

Most at risk are operators of hand-held concrete and masonry saws. They are more prone to the violent forces unleashed when a saw blade jams inside a cut than fixed saws. These forces, commonly referred to as kick-back, push-back or pull-in, are difficult and sometimes impossible to control, and place the operator at risk of serious and potentially fatal injury from an out-of control circular saw.

The best way to minimise the risk of kick-back injuries is to follow written safe work procedures that minimise the possibility that the blade may jam or bite. If jamming or biting does occur, the operator is safely positioned away from the direction of the kick-back.

Inverted cutting, ie. cutting the underside of a slab, floor or overhang should never be done with a hand-held saw, because the operator has little control of a cutting machine held above shoulder height.

Information, instruction, training and supervision are essential in all concrete and masonry cutting and drilling operations.

CAUTIONS FOR USING CONCRETE OR MASONRY CUTTING OR DRILLING EQUIPMENT

- **ALWAYS** follow the manufacturer's instructions for safe use.
- **ALWAYS** use the correct blade size, as recommended by the manufacturer. Oversize blades are dangerous.
- **NEVER** remove the guards.
- **NEVER** work off ladders, milk crates, steel drums or chairs. Use a scaffold if the work cannot be safely reached from the ground.
- **NEVER** hold a hand-held saw or drill higher than shoulder height.
- **NEVER** use a hand-held saw for inverted cutting or drilling.

Section 1
What this code is about

What work is covered?

This code of practice provides practical advice on ways to manage health and safety risks arising from the use of diamond-tipped and abrasive concrete cutting and drilling equipment used for:

- **Chasing** – cutting gutters or grooves in concrete, brickwork or other building masonry surfaces to allow for the inclusion of wires, cables, pipes or flashing.
- **Wall sawing** – cutting openings in concrete, brick or other masonry walls to provide for doors, windows, vaults, silo openings, foundations, ducts or pipes, or to remove part or all of existing walls.
- **Reinforced slab cutting** – cutting through reasonably flat and level surfaces of reinforced concrete, pre-stressed slabs or beams, pre-cast concrete and other structural materials, such as floors, roofs, bridge decks and suspended slabs.
- **Core drilling** – drilling circular holes in reinforced or pre-cast concrete, bitumen surfaces, panels for tilt-up structures, brick and other structural materials, usually for electrical, plumbing, heating, sewer and sprinkler installations. Other applications include drilling holes to anchor bolts or lifting rods, placing explosive charges or installing load carrying devices, or for analysis of structures or rock.
- **Concrete pipe cutting** – cutting concrete pipes (reinforced or not), usually done with hand-held petrol engine driven concrete cutting saws.
- **Brick cutting** – using fixed water-cooled circular saws for brick, tiles, pavers and similar.
- **Block cutting** – cutting limestone or other stone blocks to shape components for perimeter and landscaping walls, usually done with hand-held petrol engine driven concrete cutting saws.
- **Safety grooving and texturing** – to make concrete, bitumen and other surfaces more comfortable and safer to walk on, e.g. on footpaths, stairs, and public platforms and ramps.
- **Road cutting** – cutting roadways, ramps or curves for the installation of sub-surface services.

What equipment is covered?

This code of practice covers diamond-blade, water-cooled circular saws, saws powered by electricity, petrol engine, compressed air (ie. pneumatic) or hydraulics, and either hand-held, fixed to tracks on surfaces to be cut, or fitted to trolleys that may be hand moved or propelled by a motor. The code also covers power drills and core drills used for concrete and other masonry.

Who is responsible?

The *Occupational Safety and Health Act 1984* places responsibility for workplace safety on employers, employees, self employed persons, people in control of workplaces, and the manufacturers and distributors of plant and equipment.

See Appendix 1
General principles for managing occupational health in workplaces under the Act and Regulations

Employers must provide and maintain a working environment in which employees are not exposed to hazards. This includes providing information, instruction, training and supervision to enable employees to perform their work safely.

Employees must take reasonable care of their own safety and health and that of others, follow safety instructions and use protective clothing and equipment as instructed.

The *Occupational Safety and Health Regulations 1996* require employers, main contractors, self-employed persons and those in control of workplaces or access to workplaces, as far as practicable, to:

- identify each hazard to which a person at the workplace is likely to be exposed;
- assess the risk of injury or harm to a person resulting from each hazard; and
- take action to control or reduce the risk.

Protective equipment

The Regulations place personal protective equipment last as an option in reducing risk.

However, everyone involved in concrete or masonry cutting and drilling operations requires some level of personal protective equipment, depending on the risk assessment outcomes for each workplace and job.

Basic protective requirements for most concrete or masonry cutting or drilling are:

- safety helmet;
- safety footwear;
- safety goggles;
- face shield;
- hearing protection;
- sun and weather protection;
- gloves to improve grip and reduce force and vibration; and
- where hazardous dusts or fumes cannot be eliminated, respiratory protection.

Operators should avoid wearing loose fitting clothing or jewellery. Long hair worn loose and long beards can be hazardous.

Cutting and drilling equipment, especially saw blade discs and drill bits, should be removed from machines and stored where they will not be damaged between use.

More information on CHOOSING AND MAINTAINING PERSONAL PROTECTIVE EQUIPMENT is in Section 4 of this code.

Hired equipment

People who supply concrete and masonry cutting and drilling equipment for hire have an obligation under the Act to take all reasonable steps to ensure appropriate information about the safe use of the equipment is available.

The preferred way of doing this is for the supplier to demonstrate operating the machine to each customer, and allow the customer a practice run, following the manufacturer's instructions and written safe procedures on starting up, operating and stopping the machine.

More information on SUPPLYING EQUIPMENT FOR HIRE is in Section 4 of this code.

Section 2
Risks and Hazards

Who is at risk?

The people most at risk of injury or harm from concrete and masonry cutting and drilling are those operating the equipment and anyone else who is nearby.

Operators who occasionally use hired concrete cutting equipment, and, in particular, hand-held or "quick-cut" saws or unfamiliar machines, are at greatest risk because of their likely inexperience and often lack of adequate safety information, instruction, training and supervision.

People using hired concrete cutting equipment are also less likely to have the recommended back-up person standing by in case of a hazardous situation arising.

Operators are least at risk when employers, in consultation with employees, have developed an effective workplace safety policy covering concrete cutting and drilling operations and safe site and work procedures for each type of concrete and cutting equipment and job.

What are the hazards?

An appropriately qualified engineer should carry out an on-site assessment before any cutting or drilling of a pre-tensioned or post-tensioned structural component of a building or structure commences. The assessment should be documented and provided to the person contracted to carry out the work. Also, as all pre-tensioned and post-tensioned cutting will affect the structural integrity of the building or structure, a Class 1 Demolition Licence is required to carry out such work.

Some hazards are common to all concrete and masonry cutting and drilling operations, however there are also hazards specific to individual types of equipment, such as:

Obstructions or resistance in the material being cut – can cause sudden kick-back, push-back or pull-in movements of the saw. These occur when different quadrants of the blade come in contact with obstructions or resistance within the concrete or masonry, e.g. from reinforcing steel bars, steel mesh or brick ties. These potentially violent forces can be difficult to control and are most likely to cause injury when hand-held or "quick-cut" concrete saws are used. They can also cause fixed concrete saws to be wrenched from their fittings, with the potential of the saw running free on the ground.

Crooked or off-line cuts – can cause the saw to bite or pinch resulting in kick-back, push-back or pull-in reactions. These reactions are also most likely to occur with hand-held saws.

Pinched cuts – caused when the object being cut moves, resulting in the cutting groove tightening on the saw blade, thus increasing the risk of kickback etc.

Blunt cutting edges – caused by using a saw blade or drill bit with the wrong diamond cutting bond. If the bond or matrix holding the cutting diamonds together is too hard for the material being cut, the bonding material does not wear away quickly enough, resulting in the surface diamonds becoming blunt. This means extra force has to be applied by the operator, especially with hand-held saws, increasing the risk of kick-back, push-back or pull-in.

Unsafe grip, stance or stop-start procedures for hand-held saws – can cause the saw to swing out of control and come in contact with the operator, or strike objects that may cause the saw to fall and run free on the ground.

Worn, misshapen, cracked or damaged saw blades, or the wrong type of blade – can cause the blade to wobble, vibrate, shatter, or fragment and fly off. Guarding on most concrete and masonry equipment is designed to protect the operator from flying blade fragments, but not others in the workplace. Guarding should, therefore, not be regarded as a total safeguard. Blades are most likely to disintegrate when force is used, e.g. when the diamond cutting edge becomes dull, if an obstruction is encountered, the cutting groove is not straight or the blade is pinched.

Worn blade shaft – incorrectly fitted blades or the wrong type of blade for the job can cause wear on the central shaft causing even new blades to shudder, resulting in early wearing and risk of shatter.

Wrong-size blades – either too large, too small or the wrong type for the cutting machine or for the size and shape of the concrete or masonry item being cut. For example, a small diameter blade used to cut a thick slab may not penetrate sufficiently, increasing the risk of kickback or blade-shatter should the blade strike resistance.

Hazardous dusts – emitted by cutting and drilling operations or equipment that does not use water for cooling cutting parts and capturing dust. Concrete dust may carry high levels of respirable silica dust. Repeated exposure can cause silicosis, a scarring and stiffening of the lungs. The effects are irreversible, invariably resulting in death. Coarser rock particles can cause short term throat irritation and bronchitis.

Insufficient flow of coolant water – can cause overheating and expansion of both metal and masonry, resulting in poor performance, jamming, severe blade damage and projectile hazards.

Incompatible flanges and blades – can cause uneven blade movement, wear and tear and the risk of blade-shatter.

Incorrectly secured blades – nuts and flanges which are not tightened sufficiently on the saw shaft, can cause uneven blade movement and the risk of blade-shatter.

Inadequate securing of anchor points – can cause a fixed saw to break free from its track fittings.

A beard, loose hair or loose clothing – can cause the operator to become entangled with moving saw blades, drill bits and other moving parts.

Hand-held saw cutting above shoulder or below knee-height – can reduce operator control and increase the risk of kick-back, push-back or pull-in injury.

Cutting concrete pipes – requires special safe procedures to prevent the pipe from rolling or moving during cutting, particularly when a hand-held saw is used. A specific hazard during pipe cutting is pressure from the raised flange on the pipe-end causing the cut to close and pinch the saw blade, resulting in kick-back or blade shatter injury. Other hazards include the presence of steel reinforcing mesh in concrete pipes, and a practice sometimes used for pipe-cutting, involving a series of plunge cuts around a pre-drawn line on the pipe's outer surface.

Confined spaces – without adequate ventilation, petrol motor emissions containing carbon monoxide and other toxic gases can build up to hazardous levels.

Insufficient guarding – guarding on some concrete or masonry saws is more effective than on others. Purchasing policy should include consideration of the adequacy of guarding. Part of a safe work procedure should be to ensure that the manufacturer's recommended guarding is fitted to such saws. Removing guarding can greatly increase injury risk.

Electric wires, gas or water pipes – exposing services, especially in existing structures, can put the operator at risk of electrocution or exposure to toxic gases, or of explosion. Water can cause drowning or slipping.

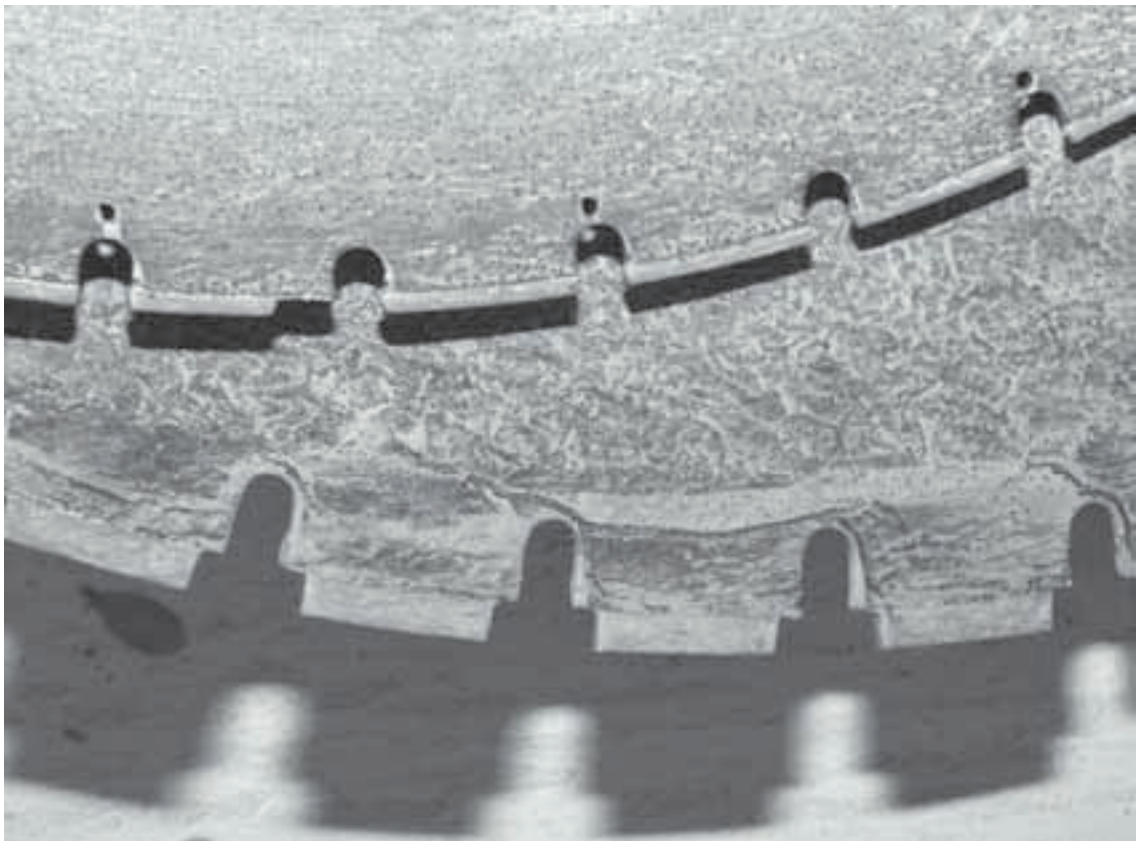
Power cords – attached to electric-powered cutting and other machinery may be cut or damaged. Pools of water coolant and slurry could cause electrocution via an immersed cord.

Wet, slippery floors – from coolant water and slurry, can cause slips and falls.

Obstructions in access ways – such as blocks of masonry, bricks etc in areas where the operator and others must stand, work or move, can cause trips and falls.

Vibration – of the whole body or hand or arm, caused by prolonged use of cutting or drilling equipment, can cause nerve, circulatory and joint damage.

Working alone – can be hazardous because of the potential need to provide assistance to the operator in the event of an unsafe incident or emergency situation.



What are the risks?

The most likely risks of injury or harm come from:

- flying saw fragments;
- saw kickback, push-back or pull-in;
- out-of-control or free-running cutting machines;
- falling concrete and masonry;
- inadequate scaffolding;
- noise;
- electrocution;
- hazardous dusts from dry cutting and drilling, contributing to lung disease;
- slips, trips and falls;
- manual handling or strain injuries;
- vibration damage to circulation, nerves and joints; and
- suffocation or poisoning from hazardous fumes or gases emitted by petrol motors and other equipment in confined spaces, or damaged gas supply services.

Section 3
Risk Analysis

See Appendix 3
Other souces of information

Identifying hazards and controlling risks

The *Occupational Safety and Health Regulations 1996* require employers, self employed persons and people in control of workplaces and workplace access to identify hazards, assess risk of injury or harm and consider how the risk should be controlled (Regulation 3.1).

These steps and the resulting safe work procedures should be regularly reviewed, especially if there are changes in the work environment, new technology or safety standards.

Developing a risk control procedure should involve all parties at the workplace, including senior managers, contractors, supervisors, self-employed persons, employees and safety and health representatives.

Decisions on safe systems of work and the means of eliminating or controlling hazards should be made in consultation with these people.

In workplaces where concrete and masonry cutting and drilling equipment is used, Regulation 3.1 means the following:

1. Hazard identification

Identifying hazards – this should include:

- Regular review of safety procedures for each type of equipment and job;
- Regular checking of information, instruction, training and supervision provided to operators for each type of equipment and job;
- Regular referral to manufacturers' safety recommendations;
- Regular inspection of equipment before each job, e.g. saw blades, shafts, flanges, guarding, hand grips, drive belts and drill bits, for wear and tear, correct assembly, and the correct functioning of safety features;
- Check the texture, shape and composition of each item to be cut or drilled;
- Check the possible presence and location of obstructions, e.g. steel reinforcing or plumbing in material to be cut;
- Identify toxic or hazardous substances;
- Identify concrete or masonry sections that will need to be supported to prevent hazardous or premature falls during cutting;
- Locate imbedded electrified wires, cables, gas or water lines;
- Identify objects likely to shift during cutting, e.g. concrete pipes;
- Check objects likely to pinch on the saw blade during cutting;
- Check correct assembly of cutting or drilling equipment components;
- Secure anchoring of guide tracks for fixed sawing of walls or floors;
- Check correct hardness of diamond cutting bond for the material being cut;
- Check compatibility of saw blade size to size, thickness, hardness and shape of material to be cut;
- Identify the likely presence of workers or the public nearby;
- Identify sections of concrete or masonry likely to fall;
- Check the presence of water and slurry lying around during cutting operations, causing electrical and slip hazards;
- Identify the manual or mechanical handling needs of cut concrete or masonry sections and heavy equipment;
- Identify any excessive noise exposure;
- Identify any excessive exposure to vibration from hand-held saws and drills.

2. Risk assessment

Assessing risks – involves calculating the likelihood and severity of injury or harm resulting from identified hazards, such as the likelihood of:

- Kick-back injury to the operator from obstructions in the material to be cut;
- Injury to an operator who has not been given information, instruction, training or supervision;
- Slip injury, electrocution or loss of saw control because of accumulated coolant water and slurry;
- Injury from an incorrect diamond bond causing blade cracking and disintegration.

3. Controlling risks

Considering means of controlling risks – e.g. by introducing safety measures to eliminate or minimise the risk of a person being exposed to a hazard.

See Appendix 3 Other souces of information

The *Occupational Safety and Health Regulations 1996* (Regulation 4.29) says risks relating to plant (including concrete and masonry cutting and drilling equipment) should be reduced by one or a combination of the following:

- **Substitution of the plant by less hazardous plant** e.g. using a fixed instead of a hand-held saw for large wall and floor-cutting jobs;
- **Modification of the design of the plant** eg. ensuring saw blades are sufficiently large in diameter to penetrate sufficiently through the thickness of material being cut;
- **Isolation of the plant** e.g. erecting barricades and clear no-entry signs to areas where concrete cutting and drilling is in progress;
- **Using engineering methods to change physical characteristics of the plant** e.g. attaching the concrete saw to a motorised trolley with anchored guide tracks, or using a floor saw, to ensure the blade stays on course during cutting;
- **Implementing, maintaining and supervising control measures to reduce the risk as far as practicable** e.g. ensuring agreed safe procedures for concrete and masonry cutting and drilling are carried out according to the job and the type of machinery used.

Any design modification or physical changes to plant must have the manufacturer's permission and approval.

Section 4
Safe Procedures

Developing safe procedures

Hazard identification and risk assessment procedures should be carried out for each type of concrete or masonry cutting or drilling job, in order to develop, implement and maintain control measures for each item of equipment and each job.

Control measures, which include safe work procedures, should be developed in consultation with all persons at the workplace, including employers, employees, supervisors, self-employed persons, persons in charge of workplaces and access, and safety and health representatives.

Control measures should be regularly reviewed through:

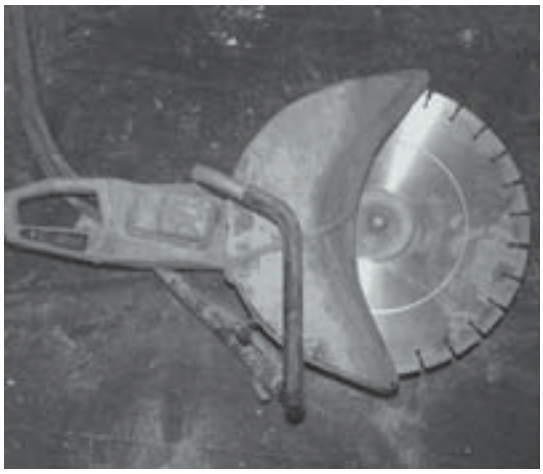
- workplace communication and consultation;
- safety and health committee meetings;
- regular equipment and work safety checks;
- incident, accident and near-miss records;
- injury and lost time records; and
- repair and maintenance reports.

Choosing and maintaining protective equipment

The type of personal protective equipment (PPE) selected for concrete or masonry cutting or drilling will depend on identified hazards associated with particular sites, conditions, materials, tasks and cutting or drilling equipment.

Selecting and providing PPE is the responsibility of the person in charge of workplace safety and health, usually the principal contractor, and should conform with agreed, written safe procedures.

Standard PPE for concrete or masonry cutting or drilling includes safety helmet, eye and hearing protection, boots and gloves and sun protection. If it is impracticable to remove hazardous dusts at the source or exhaust fumes in a confined space, appropriate respiratory equipment should be provided and worn.



Gloves help minimize cut and crush injuries as well as maintaining a safe grip on cutting and drilling equipment. Anti-vibration gloves, while not a total protection, go a long way in preventing vibration hazards leading to Raynaud's Disease (white finger).

If direct or reflected sunlight cannot be avoided by restricting outdoor work to low-sunlight hours or using temporary sun shelters, sun protection should include broad-brim hat, sunglasses, long-sleeve shirt and long trousers, as well as SPF15+ sunscreen. If working in cold weather, operators should wear waterproof gear and heavy boots if outdoor work cannot be restricted;

All clothing needs to be comfortable and suitable for the work and weather conditions. Operators should not wear loose clothing that could tangle in equipment, and long hair and beards should be covered or tied back.

PPE must be stored in a clean and fully operational condition. Storage arrangements should ensure the equipment is safe from interference and damage, and is easily accessible and ready to use when needed.

Items of PPE should be inspected regularly, as specified by the manufacturer or supplier, to ensure they remain serviceable.

Damaged or defective PPE items must be repaired or discarded.

General advice and guidance on selecting, using, storing and maintaining PPE is provided in the Commission's *Code of Practice: First Aid, Workplace Amenities and Personal Protective Clothing and Equipment 2002*.

Training and instruction

All operators using concrete and masonry cutting and drilling equipment, including hired equipment, must first know how to work safely and must be able to demonstrate a certain level of competency.

This includes employed and self employed persons who have an obligation to ensure their own workplace safety and health and workers whose training is the employer's responsibility.

Employers must ensure workers are trained in safe concrete cutting and drilling work practices, and procedures are supervised by experienced people and assessed on their competency to work unsupervised before being allowed to do so.

Training of employees should include information and instruction on:

- workplace safety and health;
- hazards and risks associated with work activities;
- safe work practices and procedures, the safe handling (including lifting and moving) and safe operation of equipment and the control measures in place;
- safe use of plant and associated equipment, safe use of hazardous substances, electrical safety, safety in confined spaces and other training required under hazard-specific regulations;
- hazardous substances relevant to the work to be performed;
- correct use, fit and care of personal protective equipment, tools and equipment and why the equipment is needed;
- emergency and first aid procedures;
- sun protection to prevent skin cancer;
- fire protection;
- information on dust, fumes and air quality; and
- recognition of poorly ventilated areas and confined spaces.

See Appendix 3
Other souces of information

Supplying equipment for hire

Under the *Occupational Safety and Health Act 1984*, suppliers of hired concrete and masonry cutting or drilling equipment must take all reasonable steps to provide safety information to customers.

This could reasonably include:

- a safety demonstration of the equipment, involving start-up, operating and shut-down procedures;
- uses for which the equipment has been designed and tested;
- manufacturer's instructions and or operator's manual;
- access to records of checks, tests and inspections which demonstrate the equipment is in safe working order;
- risk assessment, including any information about any known residual risk that cannot be eliminated or sufficiently reduced by design, and against which guarding is not totally effective;
- control measures, for example, safety training to reduce associated risks;
- personal protective equipment that should be used; and
- ways in which the equipment should not be used.

The duties of persons who supply equipment by way of hiring or leasing are covered in the *Occupational Safety and Health Regulations 1996* (Regulation 4.35).

See Appendix 3
Other souces of information

Section 5
Specific Hazards

Inverted cutting

Usually, inverted cutting is not necessary because it should be possible to make the cut from on top of the slab. This work should only be performed by appropriately trained people.

Inverted cutting – cutting the underside of a slab, floor or overhang – should never be done with a hand-held saw, because the operator has little control of a cutting machine held above shoulder height.

On the few occasions when inverted saw cutting would be necessary, a track-mounted wall saw should be attached to guide tracks bolted to the slab.

Water-cooled saws should not be electric powered and should never be used in inverted cutting. If the saw is turned upside down, water can flood into the motor and cause the electricity to earth through the operator.

Dust and gases

Where it is not practicable to use water suppression or dust extraction equipment, liquid nitrogen (eg. in furnaces) or dry ice (eg. in cool rooms) should be considered.

Consideration could also be given to the use of slower concrete and masonry cutting and drilling equipment now on the market which operates while producing little dust.

Respiratory protection may be necessary where none of these methods are practicable against dust generated by dry concrete cutting and drilling operations.

In such cases, appropriate particulate filter respirators will protect workers against fumes, dust and fibres and will, therefore, protect them against the toxic effects of substances such as lead fume or respiratory diseases caused by substances such as silica and asbestos.

However where petrol-driven machines, such as hand-held saws, are used in confined spaces, filtered air respirators are not effective against toxic exhaust gases.

The most dangerous of these gases is carbon monoxide, an invisible, odorless chemical asphyxiant, that can cause rapid loss of coordination, unconsciousness and death.

The safest procedure is to use hydraulic, pneumatic or electric powered saws and drills, rather than petrol-driven equipment in confined spaces.

However if using other less hazardous equipment is impracticable, respirators must be worn that are either self contained or connected to a supplied air source. Additional ventilation should also be provided.

In some instances, chemicals or other hazardous substances may be added as aids in the cutting or drilling operations. Safe procedures will depend on information supplied by manufacturers in the material safety data sheet (MSDS) that must be supplied with each hazardous substance.

Respirators are covered in Division 3 of the *Occupational Safety and Health Regulations 1996*, and must comply with *AS/NZS 1716: Respiratory protective devices* and be selected in accordance with *AS/NZS 1715: Selection, use and maintenance of respiratory protective devices*.

Noise

Excessive noise from concrete cutting and drilling is a workplace hazard. An operator's hearing may be damaged by very loud noise over a relatively short period or by exposure to a lower level of noise over a longer period.

In a normal working day, noise from concrete and masonry cutting and drilling equipment will result in exposure to excessive noise for the operator and others nearby.

The hearing ability of operators and workers will be at risk if no control measures are implemented.

The *Occupational Safety and Health Regulations 1996 (Regulation 3.46)* require an employer, main contractor or self-employed person, as far as practicable, to ensure that people at the workplace are not exposed to excessive noise.

The Commission's *Code of Practice Managing Noise at Workplaces 2002* provides practical advice about identifying noise sources, assessing exposure to noise, eliminating or minimising noise as a risk to safety and health at the workplace, and training.

All currently available concrete or masonry cutting or drilling equipment create excessive noise with normal daily use.

Employers, contractors, self-employed persons and employees should:

- prior to purchase or hire, obtain information on the noise output of different models from manufacturers and suppliers;
- assess the suitability of using noise-reduced saw blades for a particular job;
- select the quietest suitable model and blade available;
- keep people not directly involved in cutting or drilling at least 7 metres away from excessive noise areas;
- erect temporary acoustic barriers around cutting and drilling areas to further reduce the spread of noise;
- provide training and instruction about noise, its effects, noise control measures and the proper use and maintenance of hearing protectors; and
- provide operators and nearby workers who need to be in excessive noise areas with hearing protectors selected in accordance with *AS/NZS 1269.3 Occupational noise management – Hearing protector program*

See Appendix 3
Other souces of information

The *Workers' Compensation and Rehabilitation Act 1981* and *Workers' Compensation and Rehabilitation Regulations 1982* require certain hearing tests and audiological assessments to be carried out for compensation purposes. Contact WorkCover Western Australia for more information on these matters.

Manual handling

See Appendix 3
Other souces of information

1. Requirements

Concrete and masonry cutting and drilling involves a variety of manual handling tasks that can cause strain injuries.

Manual handling is any activity requiring force by a person to lift, lever, push, pull, carry or move, hold or restrain a person, animal or thing, that may increase the risk of injury or harm.

Concrete and masonry cutting and drilling equipment can weigh up to 30kg, and the operator may be required to hold the saw in the same awkward position for a long time.

The Commission's *Code of Practice Manual Handling 2000* provides guidance on hazard identification, risk assessment and risk control where the weights of loads handled or the forces required to move or restrain them are of concern. However this code does not apply to tasks involving repetitive or forceful movements or holding strained or awkward postures.

See Appendix 3
Other souces of information

Repetitive or forceful movements or constrained postures, such as those occurring in concrete and masonry cutting and drilling practices, are covered by the *National Code of Practice for the Prevention of Occupational Overuse Syndrome [NOHSC:2013(1994)*.

See Appendix 3
Other souces of information

That code of practice is an approved code of practice under the *Occupational Safety and Health Act 1984*, and should be complied with in concrete cutting and drilling safe procedures.

2. Hazards

Manual handling hazards in concrete and masonry cutting and drilling operations include:

- awkward or static working positions repeated or maintained for long periods;
- holding hand-held equipment over extended periods;
- lifting, pushing, pulling, levering, holding or carrying plant, equipment and cut sections of concrete or masonry;
- slip and trip hazards while handling plant, equipment or materials; and
- sudden violent reactions (kick-back, push-back or pull-in) by a saw when the blade strikes a hidden obstruction or resistance, or is pinched or jams in the cut.

3. Solutions

Manual handling solutions include:

- suspending or supporting cutting or drilling equipment in a frame to reduce the forces and the awkward and static working positions needed to position it;
- choosing lighter equipment, including smaller diameter blades, where possible;
- reducing the range of movement of the equipment to minimise the effect or forces needed to guide or control it;
- training operators in safe systems of work for handling the equipment and materials involved; and
- avoiding kick-back, push-back and pull-in situations by pre-checking blades and other saw components for wear and tear, assessing materials to be cut, locating hidden steel reinforcing and other obstructions, and avoiding hazardous cutting situations.

Vibration

Vibration transmitted from concrete and masonry cutting and drilling equipment can affect the operator's whole body or parts of the body, such as the hands and arms.

Whole body effects are generally musculo-skeletal, especially affecting the lower spine region.

Other effects include fatigue, headaches, gastrointestinal problems and reduced job efficiency.

Hand and arm vibrations may cause disturbances in the peripheral nerve and vascular systems of the hands, resulting in Raynaud's Disease (or white finger), causing loss of senses of touch, heat, numbness and loss of grip strength.

Other effects can include damage to tendons, bones and joints in the hands, wrists, arms, elbows and shoulders, and carpal tunnel syndrome.

Purchase or hire equipment that:

- vibrates less or does not have to be held or manually supported;

- is well-balanced, as light as possible and capable of being held in either hand (and different sized hands); and
- has vibration-absorbing handles, or with an even surface on the handles to distribute gripping force.

Wrapping metal handles with soft resilient rubber lagging can also effectively reduce vibration exposure.

Gloves have minimal effect on vibration exposure, though they can improve grip on the equipment and by keeping hands warm increase blood flow to the fingers.

Where practicable, use concrete or masonry cutting or drilling equipment rather than hand held jackhammers.

If there is no alternative available, hand held jack hammers should be used as little as possible and for not more than 30 minutes in a working day.

Working at height

Using concrete and masonry cutting and drilling equipment at height increases the risk of falling.

People required to work from a height where there is a risk of falling must be provided with a safe working platform and a safe means of getting to and from, and moving around, the work area.

DO NOT OPERATE CONCRETE AND MASONRY CUTTING AND DRILLING EQUIPMENT WHEN STANDING ON A LADDER.

All work at height should be done from a safe working platform, preferably scaffolding. Where scaffolding is not practicable, elevating work platforms should be used. Access to and egress from the working platform should be by:

- walkway or stairway; or
- a temporary work platform such as an elevating work platform, scaffold or personnel cage on a forklift.

Before any cutting or drilling equipment is passed from one operator to another, its motor should be shut off in case the throttle is accidentally activated.

For further guidance, see the Commission's *Code of Practice Prevention of Falls at Workplaces*.

See Appendix 3 Other souces of information

Electricity

Pooled water in a workplace (such as coolant water used in concrete or masonry cutting and drilling), increases the risk of electrocution. It should be removed with a wet and dry vacuum cleaner before any electrical equipment is used in the area.

Extension leads, plugs and electric powered tools must be kept away from dry cutting equipment, or drilling water or slurry, that cannot be easily removed.

Wet cutting should be done by hydraulic, pneumatic or petrol engine powered equipment, but never electrically powered.

The *Occupational Safety and Health Regulations 1996* (Regulation 3.21) require any existing electrical or other services (e.g. gas, water, sewerage) to be established and a diagram (or "as constructed" drawing) drawn to show their location before work begins.

Users of portable electrical equipment at workplaces must be protected against earth leakage shock by means of a residual current device (RCD) (Regulation 3.60).

All electrical equipment used in concrete or masonry cutting or drilling operations must be inspected and tagged by a licensed electrical worker (Regulation 3.62).

See Appendix 3 Other souces of information

Concrete or masonry cutting and drilling operations must comply with *AS/NZS 3012 Electrical Installations – Construction and Demolition Sites*. This standard requires that:

- portable RCDs must be tested at prescribed intervals and withdrawn from use if not working properly; and
- cords and extension leads should be suspended above head height on stands, and waterproof connectors used where water is present.

DO NOT USE ELECTRICAL CUTTING OR DRILLING EQUIPMENT FOR INVERTED CUTTING

Damage to structures

Operators and others can be at serious risk if stressed components or components that affect the integrity of a building are damaged during cutting or drilling.

If components such as stressing tendons must be cut, the person responsible for workplace safety and health must assess the risk.

This person, usually the principal contractor, should locate and mark the location of all components that will affect the strength of a structure if cut, as part of initial planning for safety.

Advice and supervision from a structural engineer should be sought for all cuts to structural components.

Damage to services

Operators risk injury to themselves and others at a work site by cutting through gas, electricity or water services. Damage could also occur to communications services.

The person responsible for workplace safety, usually the principal contractor, should locate and mark the location of all services during initial planning for safety, utilising the Dial 1100 Before You Dig service or by contacting the local government authority.

The original drawings of the services should be consulted and a search conducted for any "as constructed" drawings, in the event of a change of location of services during installation.

If the services have been moved, specialist equipment can be used to accurately determine where the services are now located prior to any cuts being made.

If services are to be cut through, they should be disconnected. Disconnections should be confirmed and tagged by the relevant service personnel before the work begins. At conclusion of the work, the service personnel should reconnect the service and, if safe, remove the tags.

Loss of vaccum pressure

Operators using a vacuum assembly to anchor a core drill stand to a surface may risk injury if the vacuum pump fills with slurry. This can cause loss of vacuum, which can result in the drill stand breaking free and rotating round the drill.

Operators should:

- use bolt down stands where practicable;
- if a vacuum attachment must be used, ensure the surface to be cut is sound; and
- monitor the equipment to ensure that vacuum pressure is maintained.

When a vacuum system is used to secure a drill stand to concrete, the compressor should have a receiver tank to ensure the operator has time to take action (if power is cut to the compressor) before the drill loses it hold.

Working alone

The risk of injury or harm may increase when an operator is working alone because of difficulties in setting up and relocating equipment on site, the nature of the work and the absence of a back-up person should an emergency arise.

An operator may be considered alone when they cannot be seen or heard by another person, and cannot expect a visit from a supervisor, another worker or a member of the public for some time.

Supervision and dealing with an emergency situation should be considered when developing safe systems of work.

Employees should refer to the Commission's publication *Guidance Note – Working Alone*.

Section 6
General duties

Following the *Act* and *Regulations*

See Appendix 3
Other souces of information

Safe procedures developed at workplaces for concrete or masonry cutting and drilling must comply with the *Occupational Safety and Health Act 1984*.

The Act sets out particular duties for designers, manufacturers, importers, suppliers, installers and users of plant. Plant is a general name for machinery, tools, appliances and equipment. It can include things as diverse as presses in a foundry and computers in an office.

See Appendix 3
Other souces of information

The Commission's publications *Plant Design – Making it safe – A guide for designers, manufacturers, importers, suppliers and installers of plant* and *Plant in the workplace – Making it safe – A guide for employers, self-employed persons and employees* set out a risk management system for plant.

A risk management process is a systematic method for making plant as safe as possible. It can be implemented in various ways, but the basic steps remain the same.

Site safety

One outcome of the risk assessment procedure should be a safe procedure for setting up and preparing a site before cutting and drilling operations. Consideration should be given to:

- weather and environmental conditions likely to affect safety;
- safe access to and from the site;
- barricades, exclusion zones and warning signs;
- specific safety and health instructions for the site and work to be done;
- whether the equipment is suitable for the work, is properly maintained and will be used according to manufacturer's recommendations;
- provision of residual current devices (RCDs) for electrical equipment;
- safe removal of cut pieces and cores;
- means of collecting water and slurry to prevent surfaces becoming slippery and residue entering storm drains. Residue should be disposed of according to environmental protection requirements; and
- ensuring adequate supplies of personal protective equipment are available at the workplace.

Site responsibility

The person controlling the site should ensure:

- work areas or platforms are suitable and safe;
- locations of all services are clearly marked and services disconnected;
- exact locations of cut lines or drill holes are clearly marked;
- cutting or drilling equipment are of correct type and in good condition;
- ground surface conditions and footwear worn ensure firm footing;
- appropriate barriers, barricades and warning signs are erected;
- work area is adequately ventilated if fuel fumes are to be emitted;
- adequate lighting is available or provided;
- specific site hazards have been identified and safe systems of work are in place, such as relocating other workers to alternative work areas; and
- wet residues and cut pieces are collected and removed.

Public safety

If cutting or drilling is to be carried out on a road or in a public place, the local government authority will require certain measures to protect the public and provide a safe route around the work area.

Local government and *Occupational Safety and Health Regulations 1996* include requirements not limited to:

- closing roads or footpaths;
- barricading or screening the work area to protect pedestrians and to prevent vehicle entry;
- displaying warning signs and caution lighting where necessary;
- lighting the area, but ensuring there is no glare or shadowing (e.g. if floodlighting is used, position it so as not to blind the operator or motorists); and
- providing level pedestrian and wheelchair access around the area.

Plant and equipment safety

The employer, contractor or owner of a floor saw, wall saw, hand-held saw or core drill should ensure the equipment is appropriate for the job and safe to operate before any cutting begins.

The operator should check the general condition of the cutting or drilling equipment before each job, to ensure the machine, saw blades, drill bits, diamond surfaces, guards, leads, hydraulic hoses, electric leads and other components are in good working order.

The employer, contractor, owner or hirer should ensure, and the operator should check:

- that appropriate checks, tests and inspections of equipment are carried out as necessary to ensure the equipment is in safe working order;
- records of inspection, repair, maintenance, alteration and cleaning of equipment are accessible and demonstrate that the equipment is in safe working order;
- the cutting blade is the correct size and type for the machine. Oversize blades should not be fitted under any circumstances;
- the diamond surface and bonding matrix comply with the manufacturer's recommendation for the material to be cut or drilled;
- blunt diamond blades are sharpened – by making cuts in a "soft" abrasive material, such as bitumen, brick work or limestone, until new diamonds are exposed;
- the blade is in good working condition, free from cracks or deterioration;
- the specified blade speed matches the saw drive speed. Only recommended blades, ensuring the revolutions per minute (rpm) rating suited for the operation should be fitted;
- the shaft and flanges are clean, undamaged, and fit snugly;
- the blade fits securely over the shaft;
- the shaft nut is tightened over the outside flange;
- the blade guard is fitted and in good working order;
- the drive belt is at the correct tension;
- for wet cutting, adequate coolant water is available;
- a floor saw is used for horizontal work at low level, so operators don't have to work on their knees. If a hand-held saw is used, it should be supported by a trolley;
- other people on the site are not at risk;
- safe removal or support of cut pieces or cores is provided;
- the equipment is protected at the power outlet with a residual current device (RCD);
- the area behind the cut is barricaded and warning signs are posted when cutting through floors or walls to prevent people entering the area;
- safe ventilation procedures are in place when petrol engine-driven saws are used in confined areas; and
- appropriate personal protective equipment is provided and worn, where risk assessment determines it should be used.

Section 7

Cutting and Drilling Equipment – Safe Practices

Track-mounted hydraulic/pneumatic wall saw

Preparation:

- an exclusion zone is established around the area to be sawed to remove the potential for other persons in the workplace to be injured in the event that the blade shatters;
- bunding is placed round the cut area to contain excess water and slurry, later to be removed with a wet and dry vacuum cleaner;
- the area to be cut is secured (especially suspended slabs or ceilings), using either a crane or propping;
- a cut-line is pre-marked with waterproof crayon or permanent marker pen;
- the wall-saw track length is measured to determine the length of cut to be carried out, allowing extra track length for the saw head;
- holes are hammer drilled along the cut line to check for reinforced bars running on the same line;
- alternatively a wider core drill hole is drilled in each corner to locate bars;
- bolt holes are drilled with templates to fix tracks to the wall, using suitable drop-in steel anchors;
- the saw blade diameter is selected to suit the requirements of the cut and technical conditions;
- oil levels are checked in the power pack and any leaks or loose hoses rectified; and
- pressure checked on the hydraulics gauge.

Operation:

- the operator and others stand away from the path of the blade when starting the machine;
- the maximum saw blade diameter (or start blade) is 730mm when making the first cut. When changing to a second blade, the blade is aligned with the previous cut before cutting resumes;
- engine revolutions should be set to provide the cutting speed recommended by the manufacturer for the material to avoid overworking the saw;
- a saw is used only with the blade rotating in the opposite direction to the cut and is not used for inverted cutting;
- the feed pressure is adjusted to match the cutting ability of the blade and the hardness of the wall to be cut;
- the main switch on the power unit is turned off if an emergency arises. This is the quickest way to stop the blade and the power unit;
- when fitting the rails, the cutting line is marked and the positions of the drill holes for the expander bolts are marked at a distance of at least 210mm from the cutting line;
- the wall mountings are hung loosely from the expander bolts so they can be adjusted when the rails are put in place and before tightening the bolts;
- correct manual handling techniques are used when lifting the wall saw onto the rails;
- any concrete blocks cut loose are secured or anchored to avoid unintentional movement;
- the area at the back of the wall, where the blade comes out when cutting through, is cordoned off to avoid injury to other people and damage to materials;
- sufficient water or coolant is used to suppress dust at the point of generation;
- appropriate personal protective equipment is worn;

- any electrical leads are safely placed so they cannot be cut or allowed to lie in wet slurry;
- the area around the hydraulic hoses is kept clean at all times;
- if the hydraulic hose is to be disconnected, switch off the power first and allow the motor to stop completely;
- any person assisting the operator is located where they will not be exposed to danger from sudden saw movement, ejection of material, a dropped machine or falling offcuts;
- if the machine stalls, the blade is raised, the machine is switched off, and the outside flanges and nuts are checked for tightness;
- the power pack is turned off and the saw blade is removed before the cutting head is lifted from the rails;
- when retracting the blade out of the wall, the saw unit is moved with the trolley feed valve to the easiest position on the rail for it to be lifted off;
- blades are removed and stored in a safe, dry place when not in use; and
- operators are given information, instruction, training and supervision for operating concrete and masonry saws and drills.

Some older saws may still have a throttle lock or "dead man's switch" that should be used only when starting the machine. If the throttle lock is used during normal operation, it may be difficult to cut power if the machine jams. Most concrete and masonry saws these days do not have a throttle lock.

Floor-cut concrete saws

Preparation:

Floor saws should be used to avoid the operator having to work in a kneeling position.

Preparation and development of safe procedures prior to cutting is the same as for wall-saw cutting, except there is usually no need for rails to be attached to guide the saw.

The blade should be lifted off the ground before starting or stopping the machine.

Operation:

- cut in a straight line;
- saw only as deep as the job specifications and conditions require;
- for masonry saws, maintain a secure grip on the material being cut, and feed the material in slowly to avoid jamming the blade;
- for concrete saws, lower the blade into the cut slowly and proceed to cut forward;
- use consistent pressure that does not force the blade to "climb" out of the cut; and
- engine revolutions should be set to provide the cutting speed recommended by the manufacturer for the material to avoid overworking the saw.

Suspended slab removal

Horizontal concrete slab areas to be cut away should have a pre-cut procedure developed which determines the method of cut and ensures the slab to be cut can be supported from beneath by scaffolding and prevented from moving.

A qualified scaffolder should ensure that adequate propping is tied into the remaining slab. Barricading should be erected around areas to be cut to ensure only those involved have access.

The slab should be cut into block sizes that can be lifted by a crane or a lifting device approved by an engineer.

A bunded dam should be placed beneath the cut area to contain coolant water and slurry until it can be removed by a wet and dry vacuum cleaner or contained in a slurry bin.

Hand-held saws

HAND-HELD CONCRETE SAWS SHOULD BE USED ONLY IN SITUATIONS WHERE THE USE OF A SELF-SUPPORTING SAW IS NOT PRACTICABLE.

Hand-held concrete and masonry saws may be petrol engine-driven, electric or hydraulic. Designed like a chain saw, they have a belt drive instead of a chain to power the circular saw attachment.

These saws are inexpensive to buy and easy to operate. They are frequently hired and have a different range of associated hazards. Due to their common use, they are more likely to cause injury or harm than self-supporting concrete and masonry cutting or drilling equipment.

The most important safety procedure for operators of this equipment is proper instruction and training. Without these, the risk of injury is high.

Of major concern is that they are often (wrongly) regarded as all-purpose cutters.

They are also more likely to be used by people who have not received sufficient information, instruction, training or supervision.

Being hand-held, they are more prone to potentially fatal kick-back, push-back and pull-in movements.

Because they are petrol driven, they are also more likely to cause hazardous fume build-up in confined spaces.

Inverted cutting – A major hazard

Never use a hand-held saw for inverted cutting.

This is probably the most dangerous way of all to use a hand-held concrete saw.

Inverted cutting entails using the top part of the circular saw blade to cut under an overhanging floor, ceiling or horizontal slab of concrete or masonry.

Danger occurs because the top section of the saw blade used for inverted cutting moves away from the operator, greatly increasing the risk of kick-back or push-back.

Inverted cutting also involves using the front upper quadrant of the blade – the blade's highest-risk kick-back zone.

Kick-back becomes even more probable if the concrete contains hidden obstructions or resistance, e.g. from steel reinforcing rods or mesh.

An additional hazard occurs when an electric saw is used for inverted cutting. Coolant water flowing into the motor can cause electrocution.

The safest procedure is to always cut from the top of a horizontal slab of concrete.

Case Study

An operator was killed in Western Australia while using a hand-held saw to cut through a section of steel-reinforced concrete pipe. The pipe was resting on the flange at one end and on the plain pipe end at the other, causing the pipe to be in a bending mode.

Pressure from the flanged pipe-end caused the cut to pinch on the saw blade, causing a fatal kick-back.

Inquiries showed that because the saw blade was not big enough for a continuous cut, the operator was using a series of "plunge-cuts" along a pre-drawn line.

Not only did this make it difficult for each cut to line up with the next, but it meant the saw blade's most hazardous component – the front upper quadrant – was being repeatedly thrust into the pipe against kick-back forces.

Pinching of the saw cut may have caused enough resistance to trigger the kick-back.

Preparation:

- hand-hold for the operator's non-trigger hand should be present;
- suitable grips for both right and left handed operators;
- saw should be as light as practicable for the type of work, to reduce risk of strain injury;
- blade should be appropriately guarded;
- well balanced equipment should have anti-vibration hand-grips that are comfortable to use and provide sufficient support. (A poorly balanced machine might require the operator's hands to be placed in dangerous positions near the blade or vibrate unnecessarily when in use, risking damage to the operator's circulation, nerves and joints);
- correct diamond cutting or abrasive compound should be used for the material being cut, as recommended by the manufacturer, so the operator does not have to force the cut;
- for horizontal cutting, the saw should be capable of cutting right-to-left as well as left-to-right without having to reposition the blade or guard;
- automatic cut-off switch should be fitted;
- no modifications should have occurred from its original manufactured form;
- establish that a pre-cut procedure is developed for the site, which has been signed off by the safety officer, electrician, plumber and saw operator;
- check the original drawings and "as-constructed" drawings (if they exist) as well as the site for enclosed cables, wiring, plumbing, steel reinforcing, structural stress components;
- ensure if pipes are to be cut that they are properly supported and chocked;
- inform others at the workplace that cutting or drilling is about to begin;
- bunt off the area with "Noise Warning" and "Danger Diamond Drilling" signs in appropriate places;
- locate any persons assisting the operator away from any danger of sudden saw movements or ejection of material;
- fuelling should be done with the saw switched off and well away from the work area;
- fuelling to be done using a funnel, not direct from a jerry can;
- check the cutting area has a clear working surface;
- check the cutting area for ventilation. In confined areas use a compressed air or hydraulically-driven saw;
- if a petrol motor must be used in an enclosed area, ensure a proper exhaust ventilation system is provided;
- collect all slurry with a wet and dry vacuum cleaner and dispose of it safely;
- no cutting above shoulder height. Anything higher should be done from a platform or scaffold;
- ensure hoses on hydraulic machines are secure and oil levels in power packs are at the correct levels;
- check ground conditions to ensure safe footing for operators;

- suspend all electric cables safely above the floor or ground level;
- when starting the machine the operator and others should stand away from the path of the blade and the operator should ensure the blade is not touching any object;
- ensure the engine is warmed up and the blade is spinning at correct speed before commencing cutting;
- ensure both hands are on the machine when cutting;
- never leave a running machine unattended;
- never carry or place the machine on the ground, or change grips between horizontal and vertical cuts, without first turning it off;
- use the handles (rather than the belt guard) to support the equipment;
- cutting and drilling should be away from combustible material, fumes, wet slurry and electrically powered equipment; and
- stop work immediately if unauthorised persons enter the work area or if any machine or blade fault is detected.

Operation:

- mark the cut line with a waterproof crayon or permanent marker;
- when cutting, stand with one foot firmly in front of the other, the body balanced and the back close to vertical;
- the operator should maintain an upright posture with both feet flat on the ground;
- avoid standing directly behind the saw;
- ensure the operator's hands do not move above shoulder height, with all vertical work above 1.7 metres done using a scaffold or safe platform;
- when cutting horizontally across a wall, the operator's hands should be at waist level;
- allow at least five minutes for a dry blade to cool enough to touch. Wet blades remain cool;
- if cutting a pipe, pull the saw forward to ensure cutting always takes place in the lower quadrant of the blade;
- make the first cut about 25-50mm deep enabling a straight cut;
- if cutting a pipe, make the cut on top of the pipe by rotating the pipe between cuts;
- if cutting a pipe, rotate the blade guard to reduce the chance of the upper quadrant of the blade contacting the pipe;
- after pre-cutting and changing to a second blade, align the blade with the previous cut before resuming cutting;
- let the machine do the work. Do not unduly push or pull the machine;
- operate at optimum blade revolutions and listen – the blade makes a swishing sound when cutting correctly; and
- immediately release the trigger if the blade jams for any reason.

Concrete core drilling

Concrete core drilling, or ring sawing, involves cutting circular holes and removing cores to allow for services such as electrical, plumbing, heating, sewer and sprinkler installations.

The procedure involves bolting a drilling mast to the concrete surface to be core-drilled.

During drilling with a circular drill bit, water from a hose connected to a tap is flushed down the hole to capture dust, remove slurry and keep the drill bit cool.

This procedure is common for all core drilling equipment, despite the fact that most equipment is electricity-driven.

Preparation:

- make sure all drill areas have been scanned for electric cables;
- check all electrical equipment has current safety tags complying with *Occupational Safety and Health Regulations 1996*;
- suspend all electric cables safely above floor or ground level;
- check all mechanical parts for loose components;
- ensure each power cable is fitted with a residual current device (RCD);
- erect barricades and clear no-entry signs to areas where drilling is in progress;
- isolate the area below drill sites on horizontal slabs, with either a spotter or “Danger Diamond Drilling” signs; and
- erect barricades around drill areas.

Operation:

- ensure holes have been marked and centres given;
- secure the core drill with anchor bolts using a hammer drill;
- ensure the drill machine is solidly fixed, with no movement of the mast. A loose fitting will mean problems down the hole;
- attach the drill to the mast, making sure it is secure;
- never attach the drill carriage to the mast with the motor running;
- drilling of all holes should start in low gear; stopping the motor before changing to a higher gear;
- feed tap pressure water into the hole to bring up slurry and keep the drill bit cool;
- fit safety covers over drilled core holes, with warning signs fixed according to Regulation 3.11 of the *Occupational Safety and Health Regulations 1996*;
- remove slurry and cores to prevent slip and trip hazards; and
- never drill inverted holes using an electric drill unless the equipment is fitted with a specifically designed water collection ring. Use hydraulically driven equipment as a safer alternative.

Appendix 1
General principles for managing occupational safety and health in workplaces

See Appendix 3
Other souces of information

The *Occupational Safety and Health Act 1984* sets objectives to promote and improve occupational safety and health standards. The Act sets out broad duties and is supported by more detailed requirements in the *Occupational Safety and Health Regulations 1996*. The legislation is further supported by approved Codes of Practice and Guidance Notes. This legislative framework is depicted below.

OCCUPATIONAL SAFETY AND HEALTH ACT →

Major provisions:
- General Duties
- Resolution of Issues
- Safety and Health Representatives
- Safety and Health Committees
- Enforcement of the Act and Regulations

supported by

OCCUPATIONAL SAFETY AND HEALTH REGULATIONS ←

The Regulations set minimum requirements for specific hazards and work practices. They include references to:

- **National Standards** developed by the National Occupational Health and Safety Commission.
- **Australian Standards** developed by Standards Australia or jointly by Standards Australia and Standards New Zealand

and

GUIDANCE MATERIAL ←

- **Codes of Practice** approved for Western Australia in accordance with Section 57 of the *Act*.
- **Guidance Notes** developed by the Commission for Occupational Safety and Health.
- **National Codes of Practice and National Standards** developed by the National Occupational Health and Safety Commission.
- **Australian Standards** developed by Standards Australia or jointly by Standards Australia and Standards New Zealand.

Access to Act, Regulations and other relevant documents

Employers are required to provide information to employees, to alert them to areas where hazards may exist and to improve their understanding of safe work practices. Regulations specify documents which must be made available for use by employees at the workplace.

The general duties – an overview

The Act contains general duties which describe the responsibilities of people who affect safety and health at work. Employers must, so far as is practicable:

- provide a workplace and safe system of work so that, as far as practicable, employees are not exposed to hazards;
- provide employees with information, instruction, training and supervision to allow them to work in a safe manner;
- consult and co-operate with safety and health representatives in matters related to safety and health at work;
- provide adequate protective clothing and equipment where hazards cannot be eliminated; and
- ensure plant is installed or erected so it can be used safely.

Employees must take reasonable care to ensure their own safety and health at work and the safety and health of others affected by their work.

Self-employed persons also must take reasonable care to ensure their own safety and health at work and, as far as practicable, ensure the work does not affect the safety and health of others.

Designers, manufacturers, importers and suppliers of plant must ensure that the plant is safe to install, maintain and use at workplaces. Safety and health information must be supplied with all plant and substances used at work.

Designers or builders of a building or structure for use as a workplace must ensure, so far as is practicable, that persons constructing, maintaining, repairing, servicing or using the building or structure are not exposed to hazards.

Hazard identification, risk assessment and risk control

Under Section 19(1)(a) of the Act, employers have a duty to ensure, as far as practicable, that employees are not exposed to hazards at the workplace. The Regulations require employers to identify hazards, and assess and control risks.

Regulation 3.1 outlines three basic steps.

- Identification of hazards which involves recognising things which may cause injury or harm to the health of a person, for instance flammable material, ignition sources or unguarded machinery.
- Assessing risk which involves looking at the possibility of injury or harm occurring to a person if exposed to a hazard.
- Controlling the risk of injury or harm which involves introducing measures to eliminate or reduce the risk of a person being injured or harmed.

It is important to regularly review these steps, especially if there are changes in the work environment, new technology is introduced, or standards are changed.

Employers should consult with safety and health representatives, if any, and employees during these steps.

1. Identifying hazards

There are a number of ways of identifying potential sources of injury or disease. Selection of the appropriate procedure will depend on the type of work processes and hazards involved.

Procedures may range from a simple checklist for a specific piece of equipment or substance to a more open-ended appraisal of a group of related work processes. A combination of methods may provide the most effective results.

Methods of identifying workplace hazards include:

- developing a hazard checklist;
- conducting walk-through surveys;
- reviewing information from designers or manufacturers;
- analysing unsafe incidents, accident and injury data;

See Appendix 3
Other souces of information

- analysing work processes;
- consulting with employees;
- examining and considering Material Safety Data Sheets and product labels; and
- seeking advice from specialist practitioners and representatives.

Some hazards such as mechanical hazards, noise, or the toxic properties of substances are inherent in the work process. Other hazards result from equipment or machine failures and misuse, control or power system failures, chemical spills, and structural failures.

Regulation 3.5 places a duty on employers to investigate hazards and injuries that are reported to them. It is important that recording systems be in place for details of hazard and injury investigations. These records will provide valuable information for identifying hazards and assessing risks.

The following table lists some types of hazards and some specific examples.

Table 1

HAZARD	EXAMPLES	OUTCOMES (examples of injury or harm)
Manual handling	overexertion/repetitive movement	sprains, strains, fractures
Falls	falling objects, falls, slips and trips of people	fractures, bruises, lacerations, dislocations, concussion, permanent or fatal injuries
Electricity	electrical current, lightning	shock, burns, electrocution
Machinery equipment	being hit, hitting objects, and being caught in or between, over-turning vehicles	cuts, bruises, dislocations, fractures, amputation, permanent or fatal injuries
Hazardous substances	chemicals such as acids, hydrocarbons, heavy metals	toxic effects, dermatitis, respiratory illnesses, cancers
Extremes of temperature	effects of heat or cold	burns, frost bite, heat stress, heat stroke
Noise	excessive noise	permanent hearing damage
Radiation	ultra violet, welding arc flashes, micro waves, lasers	burns, cancer, damaged eye sight, blindness
Biological	viruses, bacteria, fungi, toxins	Hepatitis, Legionnaire's disease, Q Fever, tetanus, HIV/AIDS, allergies
Vibration	hands and whole of body	organ, nerve and muscle damage
Psychological stress	intimidation, organisational change, violence, conflict, time pressure	high blood pressure, headaches and migraine, anxiety, depression, absenteeism

2. Analysing and assessing risks

Risk assessment of the hazards identified in the first step should result in a list of potential injuries or harm and the likelihood of these occurring. The potential for fatal injury should be considered for each identified hazard. If hazards are listed they should be in the order of the most to the least serious, eg. from fatal to minor injury.

In assessing risks, consideration should be given to the state of knowledge about the frequency of injury or disease, the duration of exposure to injury or disease sources and the likely severity of the outcomes. Knowledge gained from similar workplaces or similar processes may be relevant to this risk assessment. Items to be considered include:

- **frequency of injury** – how often is the hazard likely to result in an injury or disease?
- **duration of exposure** – how long is the employee exposed to the hazard?
- **outcome** – what are the consequences or potential severity of injury?

Assessing these three factors will indicate the probability or likelihood of injury or harm occurring to workers involved in a particular work process. It also indicates the likely severity of this harm.

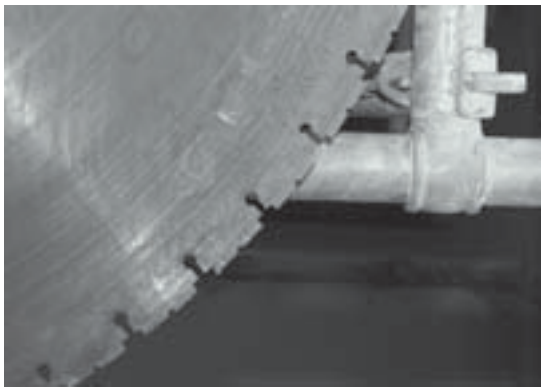
Risk assessment requires good judgement and awareness of the potential risks of a work process. Any person undertaking the risk assessment must have knowledge and experience of the work process. The task may be complicated by incomplete data or incomplete information regarding hazards of a work process.

In some cases it may be necessary to break down the activity or process into a series of parts and assess each part separately.

Risk assessment should include:

- assessing the adequacy of training or knowledge required to work safely;
- looking at the way the jobs are performed;
- looking at the way work is organised;
- determining the size and layout of the workplace;
- assessing the number and movement of all people on the site;
- determining the type of operation to be performed;
- determining the type of machinery and plant to be used;
- examining procedures for an emergency (eg. accident, fire and rescue); and
- looking at the storage and handling of all materials and substances.

This step should provide information where and which employees are likely to be at risk of incurring injury or disease, how often this is likely to occur, and the potential severity of that injury or disease risk.



3. Identifying control measures

The final step in risk assessment is to determine the control measures that need to be taken and the ongoing review of those measures. There is a hierarchy or preferred order of control measures ranging from the most effective to the least effective. The preferred order is outlined in the table below.

The control of occupational injury and disease risks should preferably be dealt with by design, substitution, redesign, separation or administration. These controls generally eliminate, reduce or minimise risk in a more reliable manner than personal protective equipment.

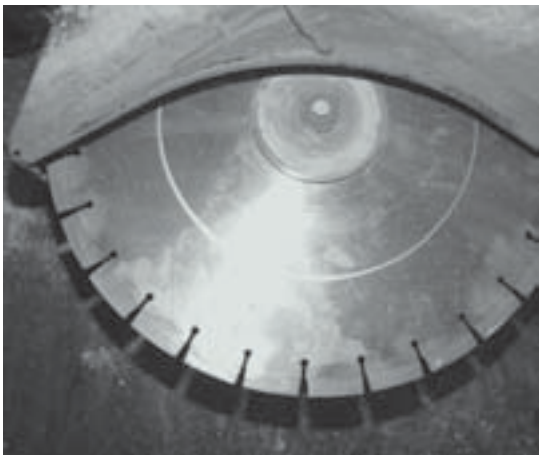
Controls involve implementing measures which reduce the hazard and risk in the workplace.

Where regulations require specific methods to control the risk, these must be complied with.

Table 2

HIERARCHY OR PREFERRED ORDER OF CONTROL	
Elimination	removing the hazard or hazardous work practice from the workplace. This is the most effective control measure;
Substitution	substituting or replacing a hazard or hazardous work practice with a less hazardous one;
Isolation	isolating or separating the hazard or hazardous work practice from people involved in the work or people in the general work areas from the hazard. This can be done by installing screens or barriers or marking off hazardous areas;
Engineering controls	if the hazard cannot be eliminated, substituted or isolated, an engineering control is the next preferred measure. This may include modifications to tools or equipment, providing guarding to machinery or equipment;
Administrative control	includes introducing work practices that reduce the risk. This could include limiting the amount of time a person is exposed to a particular hazard; and
Personal protective equipment	should be considered only when other control measures are not practicable or to increase protection.

Control measures are not mutually exclusive. That is, there may be circumstances where more than one control measure should be used to reduce exposure to hazards.



In some instances, a combination of control measures may be appropriate. Control measures should be designed:

- to eliminate or reduce the risks of a hazardous work process and to minimise the effects of injury or disease; and
- to reduce the risk of exposure to a hazardous substance.

The meaning of practicable

Some of the general duty provisions in the Act and some requirements in the Regulations are qualified by the words "so far as is practicable".

"Practicability" applies to general duties for employers, self-employed people, people with control of workplaces, designers, manufacturers, importers, suppliers, erectors and installers, and to certain requirements in the Regulations.

These people are expected to take practicable and reasonable measures to comply with the requirements.

If something is practicable, it is capable of being done. Whether it is also reasonable takes into account:

- the severity of any injury or harm to health that may occur;
- the degree of risk (or likelihood) of that injury or harm occurring;
- how much is known about the hazard and the ways of reducing, eliminating or controlling it; and

- the availability, suitability and cost of the safeguards.

The risk and severity of injury must be weighed up against the overall cost and feasibility of the safeguards needed to remove the risk.

Common practice and knowledge throughout the relevant industry are taken into account when judging whether a safeguard is "reasonably practicable". Individual employers could not claim that they did not know what to do about certain hazards if those hazards are widely known by others in the same industry, and safeguards were available.

The cost of putting safeguards in place is measured against the consequences of failing to do so. It is not a measure of whether the employer can afford to put the necessary safeguards in place.

In some instances, a combination of control measures may be appropriate. Control measures should be designed:

- to eliminate or reduce the risks of a hazardous work process and to minimise the effects of injury or disease; and
- to reduce the risk of exposure to a hazardous substance.

While cost is a factor, it is not an excuse for failing to provide appropriate safeguards, particularly where there is risk of serious, or frequent but less severe, injury.

Where a regulation exists and is not qualified by the words "as far as is practicable", the regulation must be complied with as a minimum requirement.

The Commission's Guidance Note *The General Duty of Care in Western Australian Workplaces* provides detailed information on the 'duty of care'.

See Appendix 3
Other souces of information

APPENDIX 2
Pre-site safety checklist

Site and equipment safety

Contractor's name: _____

Type of job: _____

Site location: _____

Operator's name: _____

Check the SITE for SAFETY

On arrival at the site, tick the correct answer where relevant to the job. If the answer is NO the situation is unsafe. Alert the office.

	YES	NO	COMMENT
SITE EVACUATION			
Checked with client	☐	☐	_____
Located first aid/accessible	☐	☐	_____
SCAFFOLDING			
Erected as required	☐	☐	_____
SERVICES located/marked			
Electricity	☐	☐	_____
Gas	☐	☐	_____
Water	☐	☐	_____
Other	☐	☐	_____
VENTILATION			
Adequate	☐	☐	_____
LIGHTING			
Lighting in place	☐	☐	_____
CONTROL/PUBLIC SAFETY			
Barricades in position	☐	☐	_____
Warning signs displayed	☐	☐	_____
Traffic control in place	☐	☐	_____
SAFETY EQUIPMENT			
Safety equipment is functional, clean and safe	☐	☐	_____
FALL PROTECTION	☐	☐	_____
HAZARDOUS SUBSTANCES	☐	☐	_____
SAFE SYSTEM OF WORK	☐	☐	_____

Check the EQUIPMENT for SAFETY

On setting up, tick the correct answer where relevant to the job and equipment. If the answer is NO the situation is unsafe. Alert your employer.

	YES	NO	COMMENT
FLOOR SAW			
Shaft nut secure	☐	☐	
Belt tensioned and undamaged	☐	☐	
Adequate water and waterways clear	☐	☐	
Flaps in place	☐	☐	
Guards in place	☐	☐	
HAND HELD SAW			
Belts tensioned and intact	☐	☐	
Flange locking nut secure	☐	☐	
Water supply adequate	☐	☐	
Guards in place	☐	☐	
WALL SAW			
Tracks securely fastened	☐	☐	
Blade secured	☐	☐	
Job wedged/securely supported	☐	☐	
WIRE SAW			
Pulleys secure	☐	☐	
Hydraulic pressure correct	☐	☐	
DRILLS			
Electric switch, plug and lead safe	☐	☐	
Water collar operable	☐	☐	
Carriage clamp and shims operable	☐	☐	
BLADE AND BITS			
No undercutting evident	☐	☐	
Blades free of cracks and deterioration	☐	☐	
Blade is the right size and the right type for the machine	☐	☐	
All segments secure	☐	☐	
ELECTRICAL LEADS			
Plugs in good condition	☐	☐	
Outer casing intact	☐	☐	
Correctly tagged	☐	☐	
RCDs fitted	☐	☐	
Lead stands	☐	☐	

The preparation of a Job Safety Analysis (JSA) is an example of an industry-accepted method for undertaking and recording the workplace health and safety risk management process.

APPENDIX 3
Other sources of information

Occupational Safety and Health Laws and Regulations

The *Occupational Safety and Health Act 1984* and the *Occupational Safety* and *Health Regulations 1996* can be purchased from WorkSafe Division, Department of Consumer and Employment Protection, Westcentre, 1260 Hay Street, West Perth [Tel. (08) 9327 8777] or State Law Publisher, 10 William Street, Perth [Tel. (08) 9321 7688].

These documents are available on SafetyLine www.safetyline.wa.gov.au. Copies are also held in the WorkSafe library.

Commission for Occupational Health and Safety Publications

The following Commission for Occupational Safety and Health codes of practice, guidance notes and other publications can be purchased from WorkSafe Division, Department of Consumer and Employment Protection, Westcentre, 1260 Hay Street, West Perth [Tel. (08) 9327 8777].

These documents are available on SafetyLine www.safetyline.wa.gov.au. Copies are also held in the WorkSafe library.

Codes of practice referenced in this code

- *First Aid, Workplace Amenities and Personal Protective Clothing and Equipment 2002*.
- *Managing Noise at Workplaces 2001*
- *Manual Handling 2000*
- *Prevention of Falls at Workplaces*

Guidance notes referenced in this code

- *General Duty of Care in Western Australian Workplaces*
- *Working Alone*

Australian Standards

Australian Standards and jointly developed Australian and New Zealand Standards can be purchased from Standards Australia, Ground floor, 165 Adelaide Terrace Perth [Tel. (08) 9221 6700]. Copies are also held in the WorkSafe library.

Australian and Australian/New Zealand Standards referenced in these codes

AS/NZS 1269.3:	*Occupational noise management – Hearing protector program*
AS/NZS 1716:	*Respiratory protective devices*
AS/NZS 1715:	*Selection, use and maintenance of respiratory protective devices.*
AS/ANZ 3012:	*Electrical Installations – Construction and Demolition Sites*

National Occupational Health and Safety Commission (NOHSC) Publications

The following and other National Occupational Health and Safety Commission publications can be purchased from Info Access Network Albert Facey House 469 Wellington Street Perth WA 6000.

NOHSC publications referenced in these codes

National Code of Practice for the Prevention of Occupational Overuse Syndrome [NOHSC:2013(1994).

Contacts for further information

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Website: www.docep.wa.gov.au
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Comprehensive work safety and health information can be found at:

www.safetyline.wa.gov.au

Safetyline is a service provided by the Department of Consumer and Employment Protection (www.docep.wa.gov.au)

Westcentre, 1260 Hay Street, West Perth 6005
Telephone: (08) 9327 8777
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www.safetyline.wa.gov.au
Email: safety@worksafe.wa.gov.au
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