CODE OF PRACTICE

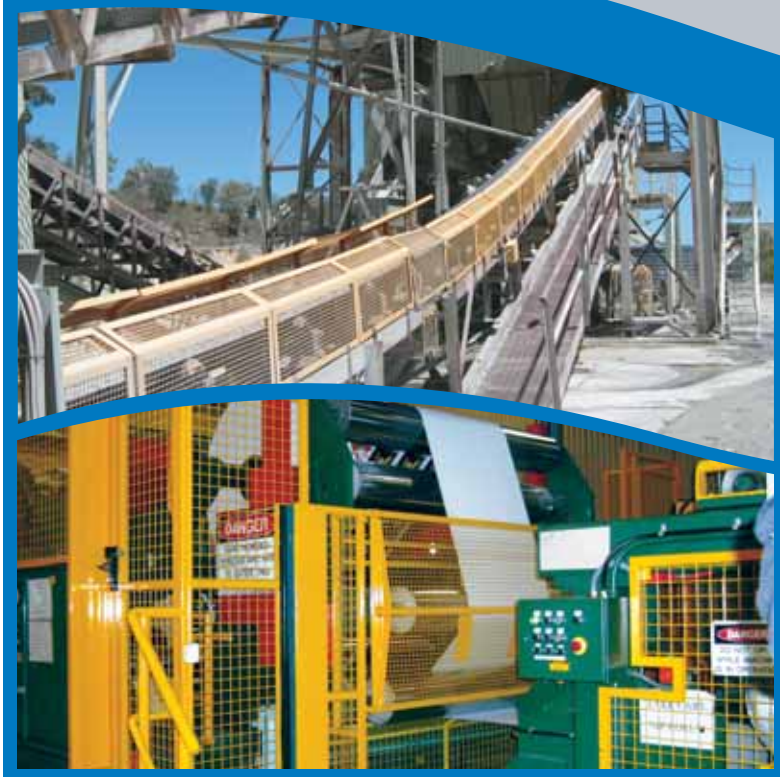
SAFEGUARDING OF MACHINERY AND PLANT

COMMISSION

Government of **Western Australia**
Department of **Commerce**
Department of **Mines and Petroleum**

Code of practice

Safeguarding of machinery and plant 2009



commission
for occupational
safety and health

MIAC

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Foreword

This code of practice is issued by the Commission for Occupational Safety and Health (the Commission) and its Mining Industry Advisory Committee under the provisions of the *Occupational Safety and Health Act 1984* (the OSH Act) and the *Mines Safety and Inspection Act 1994* (the MSI Act).

The introduction of the OSH Act enabled the establishment of the tripartite Commission. It comprises representatives of employers, unions and government, as well as experts, and has the function of developing the occupational safety and health legislation and supporting guidance material, and making recommendations to the Minister for Commerce for their implementation. To fulfil its functions, the Commission is empowered to establish advisory committees, hold public inquiries, and publish and disseminate information.

The Commission's objective is to promote comprehensive and practical preventative strategies that improve the working environment of Western Australians. This code of practice has been developed through a tripartite consultative process and the views of employers and unions, along with those of government and experts, have been considered.

The Mining Industry Advisory Committee (MIAC) was established in April 2005 under the OSH Act as a statutory tripartite advisory body on matters relating to occupational safety and health in mining. MIAC's objectives include making recommendations to the Minister for Mines and Petroleum regarding the formulation, amendment or repeal of laws under the MSI Act, and to prepare or recommend the adoption of codes of practice, guidance material, standards and specifications or other forms of guidance for the purpose of assisting employers, self employed persons, employees, manufacturers and others to maintain appropriate standards of occupational safety and health in the mining industry. MIAC may also advise and make recommendations to the Ministers and the Commission on occupational safety and health matters concerning the mining industry.

Legislative framework for occupational safety and health

Occupational Safety and Health Act 1984

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

The OSH Act places certain duties on employers, employees, self-employed people, manufacturers, designers, importers and suppliers. It also places emphasis on the prevention of accidents and injury.

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

Occupational Safety and Health Regulations 1996

Regulations under the Occupational Safety and Health Regulations 1996 (the OSH Regulations) spell out specific requirements of the legislation.

Regulations may prescribe minimum standards and have a general application, or define specific requirements related to a particular hazard or particular type of work. They may also allow licensing or granting of approvals and certificates.

Mines Safety and Inspection Act 1994

The MSI Act sets objectives to promote and improve occupational safety and health standards within the minerals industry.

The MSI Act sets out broad duties, and is supported by a further tier of statute, commonly referred to as regulations, supported by non-statutory codes of practice and guidelines.

Mines Safety and Inspection Regulations 1995

The MSI Act is supported by the Mines Safety and Inspection Regulations 1995 (the MSI Regulations), which provide more specific requirements for a range of activities.

Scope and application of this code

In October 2009, the Minister for Commerce approved this code of practice under Section 57 of the OSH Act and in November 2009 the Minister for Mines and Petroleum approved this code of practice under Section 93 of the MSI Act.

This code of practice applies to all workplaces in Western Australia covered by either the OSH Act or the MSI Act. It provides:

- general guidance for employers, designers, manufacturers, suppliers and workers on the identification and control of safety and health hazards and risks associated with guarding, or lack of guarding, of machinery and plant;
- information on key legislative requirements in the OSH Act, the OSH Regulations, the MSI Act and the MSI Regulations as they relate to guarding of machinery and plant; and
- practical guidance on guarding of machinery and plant commonly found in workplaces.

Codes of practice published under the OSH Act and MSI Act

A code of practice is a document prepared for the purpose of providing:

- practical guidance on how to comply with a general duty under the OSH Act and MSI Act or specific duties under the OSH Regulations or MSI Regulations;
- without being prescriptive, practical guidance on safe work practices that can be used to reduce the risk of work-related injury and disease; and
- a practical means of achieving any code, standard, rule, provision or specification relating to occupational safety and health in Western Australia.

A code of practice may contain explanatory information. However, work practices included may not represent the only acceptable means of achieving the standard to which the code refers. Compliance with codes of practice is not mandatory but a code may be used by courts as the standard when assessing other methods or practices used. A code of practice does not have the same legal force as a regulation and non-compliance is not sufficient reason, of itself, for prosecution under the OSH or MSI Act.

Note that there may be additional risks at the workplace not specifically addressed in this code of practice. Under the OSH Act and MSI Act, these must be identified and control measures implemented to prevent or minimise exposure.

Disclaimer

The information contained in this publication is provided in good faith and believed to be reliable and accurate at the time of publication. However, the information is provided on the basis that the reader will be solely responsible for assessing the information and its veracity and usefulness. The State shall in no way be liable, in negligence or howsoever, for any loss sustained or incurred by anyone relying on the information, even if such information is or turns out to be wrong, incomplete, out-of-date or misleading.

In this disclaimer:

- State means the State of Western Australia and includes every Minister, agent, agency, department, statutory body corporate and instrumentality thereof and each employee or agent of any of them;
- information includes information, data, representations, advice, statements and opinions, expressly set out or implied in this publication; and
- loss includes loss, damage, liability, cost, expense, illness and injury including death.

Contents

1. Introduction and purpose

Inadequate guarding of all types of machinery and plant found in workplaces, such as augers, power take offs (PTOs) and food mixers, has led to serious injuries.

This code of practice has been developed to help people meet their legal obligation to ensure that, as far as practicable, machinery and plant in the workplace are designed safely and adequately guarded so they do not pose a risk of injuries or harm.

This code outlines a range of hazards associated with common machinery and plant, as well as risks that may result from these. Its focus is on the risk management process and providing practical guidance on methods that can be used to guard common machinery and plant at the workplace. It also includes advice on what to consider when designing appropriate guards.

As workplaces and industries have different machinery and plant, it is suggested that the risk management approach be tailored for the unique demands of each workplace and/or industry, as there may be additional hazards and risks not addressed in this code.

What are machinery and plant?

In this document:

- 'machinery' is a collective term for machines and their parts. A machine is considered to be any apparatus that has interrelated parts and is used to perform work; and
- 'plant' is a general name for machinery, equipment, appliance, implement or tool and any component or fitting or accessory of these. It can include things as diverse as presses in a foundry, underground drill jumbos in mining and photocopiers in an office. It can range from electric drills, lifts, escalators, tractors, haulpaks, hand trolleys, cranes, commercial fishing nets to arc welding gear. Fittings, connections and accessories are also considered to be plant.

For further definitions used in this code, see the glossary in Appendix 4.

1.1 Overview of duties

The *Occupational Safety and Health Act 1984* (the OSH Act), *Mines Safety and Inspection Act 1994* (the MSI Act), Occupational Safety and Health Regulations 1996 (the OSH Regulations) and Mines Safety and Inspection Regulations 1996 (the MSI Regulations) impose general and specific obligations on:

- designers of plant;
- manufacturers of plant;
- importers of plant;
- suppliers of plant;
- erectors and installers of plant; and
- employers and employees who use plant at the workplace.

Designers, manufacturers, importers and suppliers

The OSH Act and the MSI Act set out broad duties for people who design, manufacture, import or supply plant for use at workplaces. These duties are to ensure that the design and construction of plant does not expose people who properly install, maintain or use it to hazards.

See Section 23 of the OSH Act or, for mining workplaces, Section 14 of the MSI Act. See also Section 4.1 of this code and, for a list of legislation, see Appendix 1.

The OSH Act and the MSI Act also include similar duties for those who design or construct buildings or structures.

General duties at the workplace

All people at the workplace have responsibilities for safety and health at the workplace. The employer's general 'duty of care' obligation is to ensure that, as far as practicable, workers are not exposed to hazards and risks that could arise from machinery and plant, and to address these through a systematic risk management process.

For more information on the 'duty of care' obligations, see the Commission's guidance note, *General duty of care in Western Australian workplaces* and Resources Safety's *General duty of care in Western Australian mines — guideline.*

Workers have a responsibility to take reasonable care to ensure their own safety and health and that of others affected by their work.

See Appendix 4 for definition of 'practicable' under the OSH Act and the MSI Act.

Providing guards on machinery and plant at the workplace

Employers, main contractors, self-employed people and people who have control of a workplace or its means of access must ensure that every dangerous part of fixed, mobile or hand held plant is, as far as practicable, securely fenced or guarded. The term 'as far as practicable' covers situations in which it would not be practicable to completely guard all dangerous parts of a machine, for example the guide bar and chain on a chainsaw.

See regulations 4.37(1)(f) and 4.29 of the OSH Regulations, or for mining industry workplaces, see regulations 4.4(3) and 6.2 of the MSI Regulations.

The types of guarding to be provided for different cases and other requirements are contained in the OSH Regulations and MSI Regulations. Some of these are outlined in Section 2.3 of this code.

Consultation

Consultation between employers and workers and, where they exist, safety and health representatives is an important part of the risk management process to identify hazards from machinery and plant and develop measures to eliminate or reduce the associated risks, before an injury or incident occurs.

See Section 19(1)(c) of the OSH Act, or for mining industry workplaces, see Section 9(1)(c) of the MSI Act.

Consultation is emphasised in the OSH Act and the MSI Act, with an obligation placed on employers to consult workers and, where they exist, safety and health representatives on safety and health. To complement this, workers have a duty to cooperate with their employer on safety and health matters.

Additional information

This code should be read in conjunction with:

- the OSH Act;
- the OSH Regulations;
- the MSI Act (for mining industry workplaces);
- the MSI Regulations (for mining industry workplaces);
- where required, the Australian Standard, *AS 4024 Safety of machinery* series;
- where relevant, Australian Standard, *AS 1755 Conveyors — Safety requirements;*
- relevant manufacturers' instructions and operators' instructions and manuals; and
- where they exist, relevant industry codes and guidance notes.

The following Commission guides may also assist:

- *Isolation of plant;*
- *Plant design: Making it safe: A guide for designers, manufacturers, importers, suppliers and installers of plant*;
- *Plant in the workplace: Making it safe: A guide for employers, self employed persons and employees*; and
- *Powered mobile plant: Making it safe: A guide for employers, self-employed persons and employees.*

Useful information may also be found in *Machinery and equipment safety: An introduction* published by WorkSafe.

The above Commission and WorkSafe documents are available at www.worksafe.wa.gov.au

Other sources of information on guarding are listed in Appendix 3.

2. Risk management: the three step process

See regulation 3.1 of the OSH Regulations.

The OSH Regulations contain a specific requirement for employers to undertake a risk management process.

This involves a three-step process to:

- identify hazards;
- assess risks of injury or harm arising from each identified hazard; and
- control risks through implementation of control measures to eliminate or reduce them.

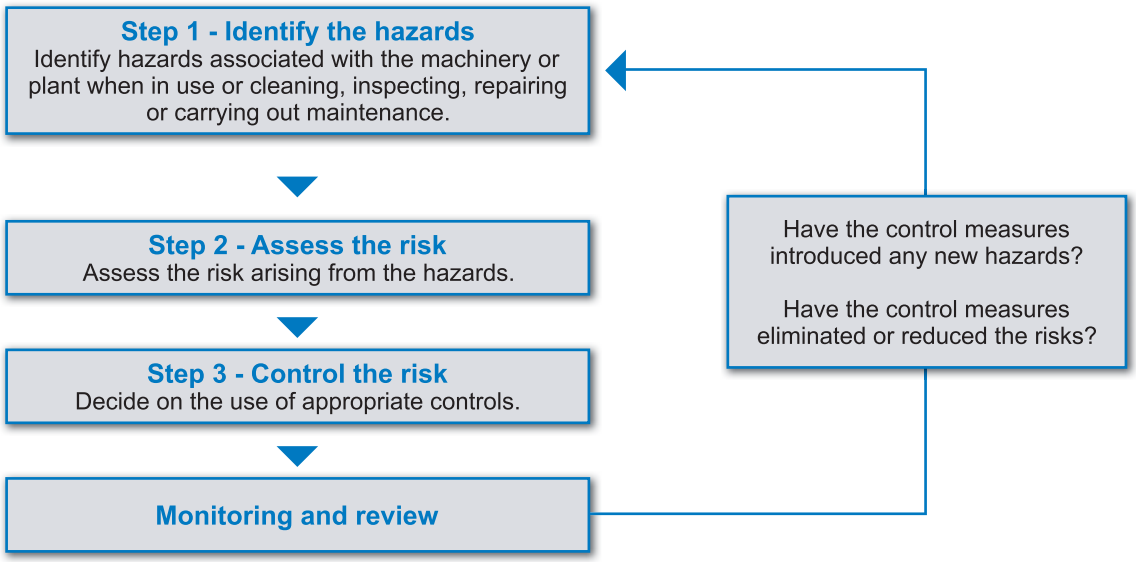

Illustration 1. Risk management steps.

See Section 9 of the MSI Act.

For workplaces covered by the MSI Act, the risk management process should be undertaken to ensure employers comply with their 'duty of care' obligations to provide a safe workplace.

The risk management process should be conducted and monitored on an ongoing basis to ensure control measures are working and no new hazards have been introduced. For example, conducting it when new machinery or plant is introduced, modifications are made to existing plant or machinery or changes are made to systems of work.

See Sections 19(1)(c), 23D, 23E and 23F of the OSH Act and Section 9(1)(c) of the MSI Act.

Workers and, where they exist, safety and health representatives must be consulted on safety and health matters. Their involvement in the risk management process is important, as they are most likely to know about the risks associated with their work.

See also the Commission's guide, *Plant in the Workplace: Making it safe: A guide for employers, self-employed persons and employees* and WorkSafe's *Machinery and equipment safety: An introduction.*

2.1 Step 1: Hazard identification

The first step in the risk management process is identifying hazards. This involves identifying anything that may cause injury or harm to the health of a person.

Identify all machinery and plant used

Start by identifying all items of machinery and plant used at the workplace. An inspection should be carried out looking for any of these items. Include common items that may not normally be thought of as 'machines' or 'plant'.

Identify the hazards

Once all machinery and plant have been identified, the hazards associated with them can be identified.

Three broad sources of hazards

There are three broad sources of hazards relevant to machinery and plant. They are:

- hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
  - drawing in or trapping hazards;
  - entanglement hazards;
  - shearing hazards;
  - cutting hazards;
  - impact hazards;
  - crushing hazards;
  - stabbing and puncturing hazards;
  - friction and abrasion hazards;
  - hot or cold hazards;
  - ejection hazards;
  - other contact hazards;
  - noise hazards; and
  - release of hazardous substances;
- hazards related to the location of the machine or plant, for example:
  - its stability, for instance, whether it could roll or fall over;
  - the environment in which it operates; and
  - its proximity to other structures; and
- hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them. See Appendix 6.

Critically inspect each piece of machinery and plant and the way it is operated to identify any parts, processes, operating procedures or workplace activities and any related danger zones, such as moving parts of machinery and plant, that may cause harm.

One process to identify hazards is shown in the following diagram.

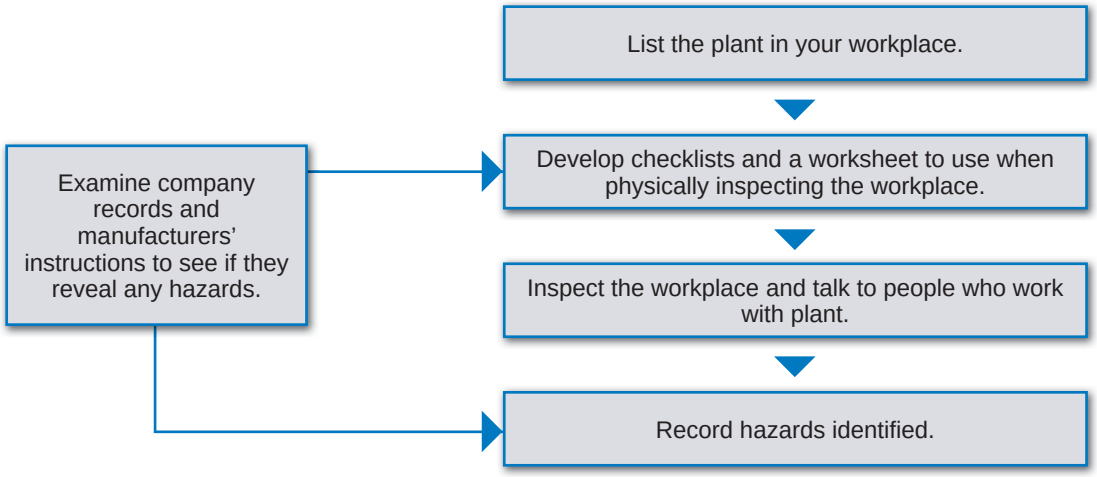

Illustration 2. A process to identify hazards.

Common injuries associated with machines are crushing, cutting, shearing, puncturing, abrasion, burns, tearing, stretching or a combination of two or more of these. Other common injuries include electric shock, hearing loss and ill health from the release of hazardous substances or lack of oxygen.

Common situations resulting in injury or harm to people include:

- coming into contact or entanglement with parts of a machine or plant, for example a worker being drawn into a machine or item of plant or being drawn into a position where they might sustain further injury;
- being caught between a moving section of machine or plant and the material being used to manufacture a product;
- coming into contact or entanglement with material being used in the machine or plant to manufacture a product;
- being caught between a machine, plant, machine part or plant part and a fixed structure such as a wall, column or fixed machine;
- being struck by parts of the machine or plant during its failure or break-up;
- being struck by material ejected from the machine or item of plant; and
- being struck as a result of a release of potential energy in machine components or materials being processed.

Useful guidance on the principles of machinery and equipment safety and risk control can be found in the Worksafe document, *Machinery and equipment safety: An introduction.*

Factors to consider in identifying machinery and plant hazards

Consider:

- tasks undertaken such as operating, clearing blockages, cleaning, adjusting, setting up, maintaining, repairing or working on a machine or item of plant;
- location such as proximity to other machines and work processes, fixed plant, portable plant and tools;
- installation of the machinery or plant so it is safe and has been done correctly;
- production processes such as forming and finishing;
- walkways and pedestrian access in the vicinity of plant, including access for routing operating and maintenance activities;
- use of mobile plant;
- safe transportation of mobile plant; and
- if appropriate, individual factors such as age, background and self management skills of those who might be operating or come into contact with the machinery or plant and levels of instruction, training and supervision that might be required.

Identifying less obvious hazards

Where machinery and plant hazards are not immediately obvious, activities to help identify them include:

- testing, particularly of plant and other equipment and noise levels;
- using scientific or technical evaluation;
- consulting workers;
- analysing records and data including workers' compensation data, incidents and near misses, hazard reports, sick leave and staff turnover;
- obtaining information from designers, manufacturers and suppliers;
- obtaining information from other organisations such as WorkSafe, Resources Safety, unions, employer bodies and occupational safety and health consultants;
- obtaining specific safety information such as safety alerts or significant incident reports and relevant codes or guides from WorkSafe and Resources Safety;
- in situations where more technical information is sought, using risk assessment techniques, such as Failure Mode Effect Analysis, Hazards and operability (HAZOP) studies and Fault Tree Analysis; and
- carrying out environmental and medical monitoring where required.

Use a wide range of information sources to help identify hazards

Sources of information to help in identifying hazards include:

- consulting workers and, where they exist, safety and health representatives working with the machinery or plant;
- Australian and Australia/New Zealand Standards;
- manufacturers' instructions and advice;
- maintenance logs of machinery or plant;
- documentation relating to safe work practices and their effectiveness;
- injury or incident information and hazard alerts;
- relevant reports from occupational safety and health agencies, unions, employer and professional bodies;
- articles from safety and health journals; and
- safety information from safety authorities on the Internet.

2.1.1 Examples of hazards

Hazards may include, but are not limited to, those shown in the following pages.

Note that the machines and items of plant are shown in their unguarded state to demonstrate the hazards and danger zones.

Drawing-in or trapping hazards

In the context of machinery and plant, 'nip-point' means a point in or around the machine or item of plant with the potential to nip a body part.

Injuries can be caused when a part of the body is drawn into a 'nip-point', formed by:

- in-running nips between two counter-rotating parts, for example meshing gears, rolling mills, mixing rolls and press rolls;
- in-running nips between a rotating surface and a tangentially moving surface, for example a power transmission belt and its pulley, a chain and its chain wheel, and a rack and its pinion;
- running nips between a rotating surface and a tangentially moving surface where material, for example metal, paper, cable or rope, runs on to a reel, drum or shaft; and
- nips between rotating and fixed parts, which create a shearing, crushing or abrading action, as in spoked hand-wheels, flywheels and screw conveyors.

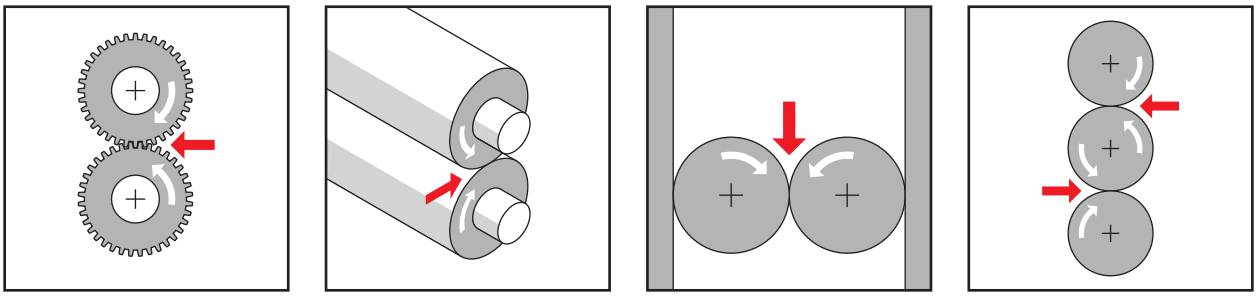

Illustration 3. Drawing-in hazards between counter-rotating parts.
Solid red arrows = where a part of the body could be drawn into a 'nip-point'.
White arrows = movement of machine parts.

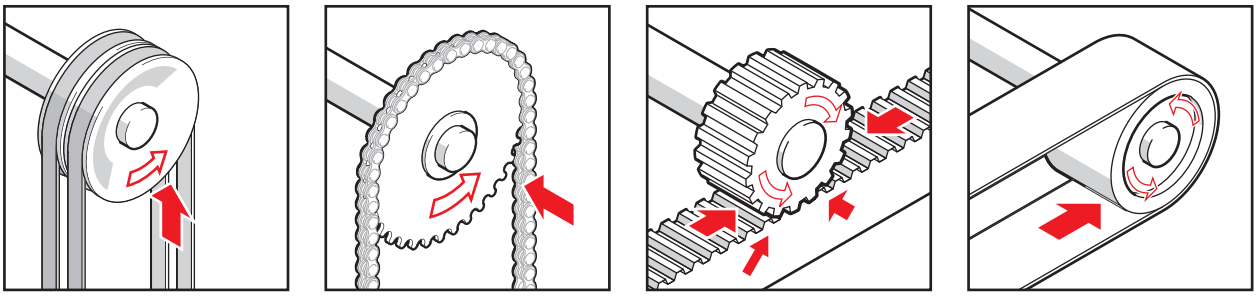

Illustration 4. 'Nip-points' (drawing in hazards).
Solid red arrows = 'nip-points'. White arrows = movement of machine parts.

Entanglement hazards

Entanglement involves being caught in a machine by loose items such as clothing, gloves, ties, jewellery, long hair, cleaning rags, bandages or rough material being fed into the machine. The types of body contact that may lead to entanglement include:

- contact with a single rotating surface, for example plain shafting, couplings, spindles, chucks, leadscrews, mandrels or rotating work pieces including plain bar material;

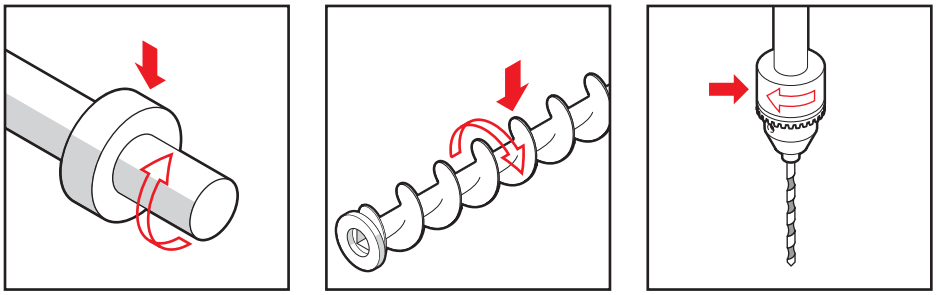

Illustration 5. Contact with single rotating surface.
Solid red arrows = where entanglement can occur. White arrows = movement of machine parts.

- being caught on projections or in gaps. Belt fasteners and other projecting items, such as keys, set screws and cotter pins, are typical projection hazards. Fan blades, spoked wheels such as pulleys, sprockets, gear wheels and flywheels, mixer and beater arms and spiked cylinders are gap related hazards;

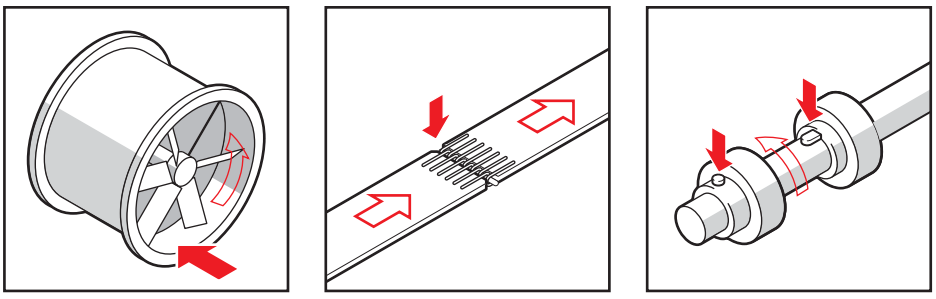

Illustration 6. Catching on projections or gaps.
Solid red arrows = where entanglement can occur. White arrows = movement of machine parts.

- contact with materials in motion such as in centrifuges, tumble driers and dough mixers or swarf from machining operations;
- contact between counter rotating parts, for example gear wheels or rolling mills;
- contact between rotating and tangentially moving parts, for example a power transmission belt and its pulley, a chain and chain wheel, a rack and pinion, a conveyor belt and any of its pulleys and a rope and its storage reel; and
- contact between rotating and fixed parts, for example spoked handwheels or flywheels and the machinery bed, screw or worm conveyors and their casings, revolving mixer and mincing mechanisms in casings having unprotected openings, mixers, extruder screw and barrel or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

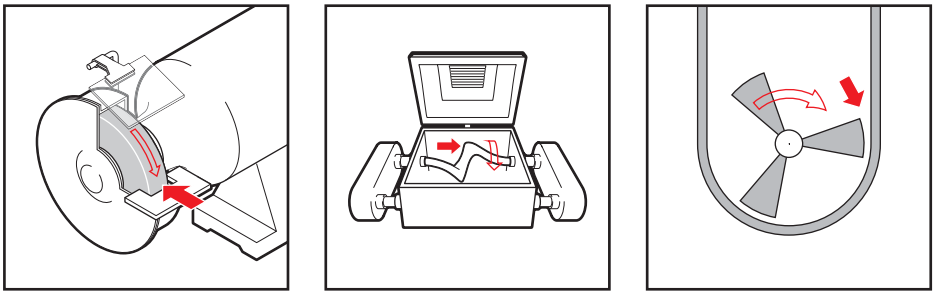

Illustration 7. Catching between rotating and fixed parts.
Solid red arrows = where entanglement can occur. White arrows = movement of machine parts.

No loose clothing, jewellery or long hair

To start addressing the risks from entanglements, requirements that workers not wear loose clothing or jewellery and tie back long hair or wear head covering should be introduced.

Shearing hazards

Shearing action involves applying power to a slide or knife in order to trim or shear metal or other materials. Shear points occur where stock is actually inserted, held and withdrawn.

Parts of the human body can be sheared:

- between two machine parts, for example the table of a metal planing machine (shaper) and its bed, the table and blade of a guillotine or power press, nip points between connecting rods or links and rotating wheels or between parts that oscillate; and
- between a machine part and a work piece, for example the tool of a broaching machine and the part being broached.

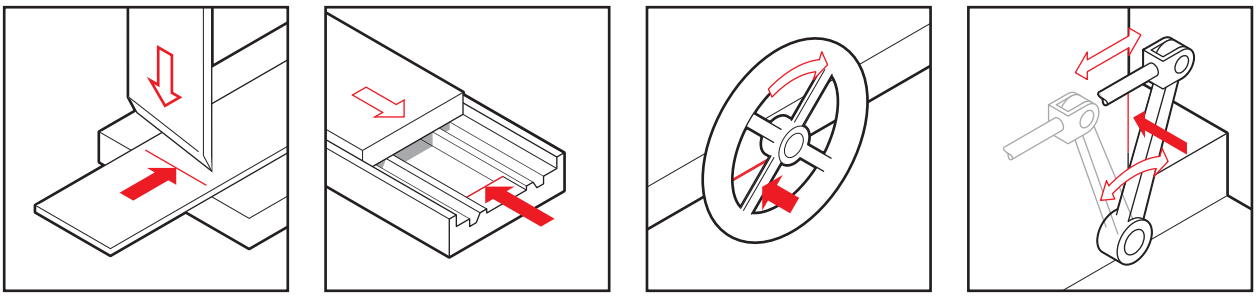

Illustration 8. Shear hazards between two machine parts.
Solid red arrows = where parts of the body can be sheared. White arrows = movement of machine parts.

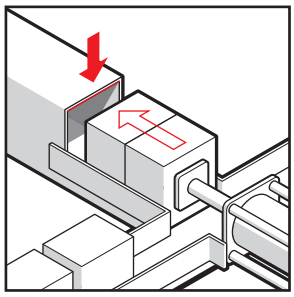

Illustration 9. Shear hazards between a machinery part and a workpiece.
Solid red arrows = where parts of the body could be sheared. White arrows = movement of machinery part.

Cutting hazards

Cutting hazards are present at the point of operation in cutting wood, metal, or other materials. Examples of mechanisms involving cutting hazards are all kinds of cutting tools, band and circular saws, boring or drilling machines, planing and tenoning machines, milling machines, water jet cutting, high energy lasers or moving sheet material in a machine.

Cutting hazards may involve rotating, reciprocating, or transverse motion. The danger of cutting action exists at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head, particularly in the area of the eyes or face. The cutting effect may be aggravated by the body being unable to move away from the cutter.

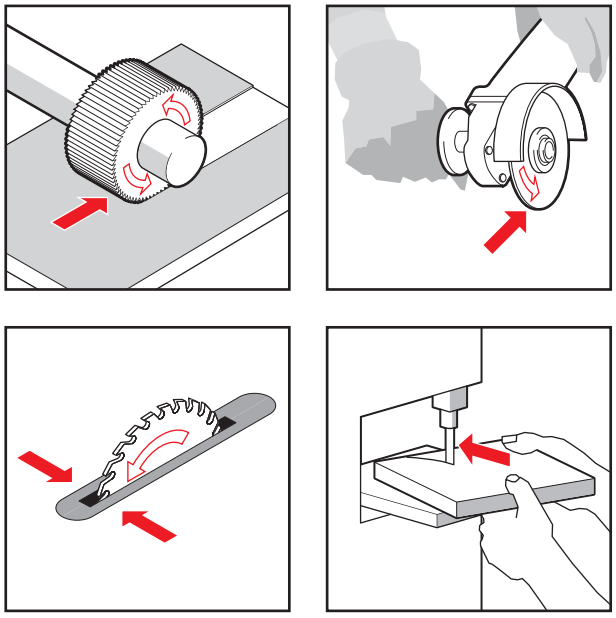

Illustration 10. Typical cutting hazards.
Solid red arrows = where parts of the body could be cut. White arrows = movement of machinery part

Impact hazards

Impact hazards relate to objects that strike the human body, but do not penetrate it. Examples include the rotating arm of a robot, the reciprocating bed of a metal planing machine and the pendulum movement of the arms of a wool scouring machine.

Impact hazards are different to crush hazards although the machines involved may be the same. Impact hazards operate against the inertia of the body whereas crush hazards involve the trapping of the body between two machine parts or between a machine part and a fixed structure.